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VETERINARY MEDICINE AND SURGERY

(*Reprint of "SHORT NOTES ON VETERINARY MEDICINE AND SURGERY FOR THE USE OF STUDENTS," by J. Hugo Reed, Professor of Veterinary Science.*)

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SHORT NOTES ON

VETERINARY MEDICINE and SURGERY.

PATHOLOGY.

Pathology means a discourse on disease.

Health is that condition of the body when all the functions are performed with regularity and harmony. (Exception, a blind man.)

Disease is a deterioration from the healthy standard, whether of structure or function.

It is necessary to be conversant with the definitions of certain technical terms that are frequently used in discussing diseases.

Etiology treats of the causes of diseases, predisposing and exciting. There is always a cause, but often hard to find.

Symptomatology, or study of the symptoms of disease, or the means by which disease is recognised from the symptoms presented by the organ or organs affected. Symptoms may be general or local.

Diagnosis is the discrimination of disease.

Prognosis is telling the probable termination of disease.

Therapeutics, that branch of medicine which has reference to the treatment of disease.

Diseases are classified under different names according to the progress and character of the disease.

An Epizootic (epidemic) disease is a disease that affects a large number of animals similarly at the same time without any appreciable cause.

Enzootic diseases are confined to localities and are due to local causes. May or may not be contagious.

A Specific disease is one peculiar to a certain class of animal, the virus of which, if introduced into another animal, may produce the same disease. (Not necessarily contagious.)

Sporadic, one due to accidental causes.

Zymotic, due to a poison causing a ferment in the blood.

A Contagious or infectious disease is one that can be transmitted to another animal (not necessarily of the same species) by the introduction into its system of the virus of the disease.

Most diseases consist in some changes in the blood. In a living body there is a continual change taking place, and the great characteristics of these changes are the processes of decay and reparation, which terminate only with life. Substances pass into the blood and are carried into all parts of the body. Waste is taken up in the blood and carried from the body. The body wastes during the day, or time of labour, and during repose it is nourished and the waste repaired. The human body, during one year, loses about 3,000 lbs. by waste of tissue, and the repair equals the waste. In youth the repair exceeds the waste, so that the animal gradually grows. In the adult they are just about equal, provided there be a certain amount of exercise. In old age the waste is in excess and the body becomes smaller. In disease a change takes place, the equilibrium is upset, and there is a change of function or structure. Life is maintained in the body by the circulation of pure or arterial blood through the system. This blood is the fluid of the body; whenever arterial blood ceases to circulate, death is the result, or if it circulates and becomes impure, there follows a similar result. If the blood becomes changed but slightly, disease is quickly produced. If the change be great, death soon results.

Life may be defined as the aggregate of the functions which resist death, while Death may be said to be the cessation of all the functions, the aggregate of which maintain life.

DEATH may occur in different ways. If no blood circulates, death takes place from SYNCOPE, or death beginning at the heart from a want of a supply of blood. Bleeding causes death from Syncope, the heart losing its stimulus—the blood. Death from Syncope may occur in other ways. The heart may lose its contractile powers from a blow over the heart or stomach, or from poisons, or from fright, or from derangements of the nervous system.

Death from ASPHYXIA or APNŒA results from want of access of air into the lungs, as in drowning, choking, hanging, etc.

Death from COMA begins in the brain, caused by injury or disease, frequently from medicines, acting upon the organ and destroying its functions.

NECRŒMIA, or death beginning in the blood, is said to occur in those fatal diseases in which the blood loses its natural character, the result of decomposition.

BLOOD.

Blood is the great and important fluid of the body, and is carried through the system by means of a set of vessels ; they are ARTERIES, CAPILLARIES and VEINS. The HEART is the great centre of the circulation, it acts as a force-pump and sends the blood through the system, but there is a power in the vessels of drawing the blood to them to a certain extent, somewhat as the sap is drawn up in a tree. All the tissues of the body, whether bone, muscle, hair, etc., are nourished by the blood. Blood is of a red colour viewed as a whole, and is a fluid, but not a perfect fluid. It is composed of a fluid portion, LIQUOR SANGUINIS, and a solid portion, CORPUSCLES OR BLOOD CELLS ; these are of two kinds, the RED and the WHITE, the average in number being about 250 red to 1 white, but they vary in both health and disease. These corpuscles float in the liquor sanguinis. The red ones give colour to the blood. In warm-blooded animals the white corpuscles are the larger of the two and are rather irregular in outline, and change their form to a great extent. The red corpuscles also change during disease.

The amount of blood in an animal is from one-tenth to one-eighth of the weight of the animal. (Authors differ as to the analysis of blood, but we accept the following :—

Analysis of Blood.

Water ..	785.0
Albumen	69.0
Fibrin ..	3.0
Alkaline and neutral salts ..	8.5
Fatty and extractive matters	7.5
Corpuscles ..	127.0
Total ..	1,000.0)

Albumen, fibrin and salts in solution form the liquor sanguinis, which gives liquor sanguinis 873, corpuscles 127 parts in 1,000. Alkaline and neutral salts are as follows : chloride of sodium, chloride of potassium, phosphate of soda, carbonate of soda, phosphate of magnesia, phosphate of lime, phosphate of iron, oxide of iron.

Living or circulating blood is composed of a solid and fluid substance. The corpuscles are the solid portion and the remaining constituents form the fluid portion or liquor sanguinis. The serum is the liquor sanguinis minus the fibrin. When blood is drawn from the body and allowed to stand, it separates into two portions, coagulates, forming the clot and the serum. This coagulation depends upon the presence of fibrin, which has the power of spontaneously coagulating, and forms a network of fibres, in the meshes of which are included the red and white corpuscles. The clot then contracts and squeezes out the serum. If health is to be preserved, it is necessary that the constituents of the blood should be present in proper quantities.

Functions of the Constituents of the Blood.

Water holds in solution different salts and gives fluidity to the blood and secretion.

Albumen is the substance from which the tissues of the body are formed.

FIBRIN gives plasticity to the blood, prevents it from passing through the coats of the vessels, and arrests bleeding by plugging up the mouths of open vessels.

RED CORPUSCLES carry the oxygen to the tissues, and deport carbonic acid from them to the lungs, where it is eliminated. They also prepare the materials of the blood which are to be used in the nutrition of the tissues.

WHITE CORPUSCLES are also concerned in the preparation of nutrient material for the tissues of the body.

ALKALINE SALTS, as sodium and potassium, are necessary to give the blood its alkalinity, and to hold in solution its albumen, and to facilitate the passage of the blood through the capillaries.

LIME PHOSPHATE, CARBONATE and FLUORIDE are required to build up the solid tissues, as bone and teeth.

FATS afford material for the combustive process which is necessary for the maintenance of animal heat.

The EXTRACTIVE matters are the result of retrograde change and are rapidly eliminated from the system by the lungs, kidneys, skin, etc.

We have VENOUS, or dark red blood ; and ARTERIAL, or blood of bright red colour. The dark blood is carried to the heart, thence it is forced to the lungs where the carbonic acid is given off and oxygen taken on, which changes the colour to a bright red.

Inflammation.

INFLAMMATION may be defined to be perverted nutrition of a living part, the effect of irritation or injury. NUTRITION takes place in the following manner. The red corpuscles move rapidly along in the centre of the stream of blood in a small vessel, while on either side and close to the wall of the vessel there is a space containing liquor sanguinis and a few white corpuscles which move much more slowly than the blood in the centre of the stream. The fluid part of the blood is that chiefly concerned in nutrition. It contains the nutritive elements in solution which is absorbed by the various tissues.

The CAPILLARIES consist of a single coat of delicate membrane so that the nutritive material can easily pass out of them, and nutrition is cȧrried on entirely in the tissues which fill up the space between the capillaries. Every tissue has an inherent power of attracting and selecting from the blood those constituents best suited for its nourishment. From this it will be seen that the fluid part of the blood is continually transuding through the walls of its vessels for the purpose of nourishing the tissues. A perversion of this, with a rapid transformation of the transuded material, and an altered mode of growth of the elements of the inflamed texture constitute the inflammatory process.

The CAUSES of inflammation are predisposing and exciting. The former are debility of an organ, or of the whole body arising from old age, previous disease or a natural weakness, hereditary taint, climatic influences, dietetic errors, insufficient ventilation, ill treatment, etc. The exciting causes are direct violence, the application of irritants, exposure to heat and cold, the presence of foreign bodies, abnormal condition of the blood, etc.

SYMPTOMS, redness, pain, heat and swelling. Redness can only be detected on white parts of the body and on the visible mucous membranes in our patients; it arises from an increased supply of blood to the part.

PAIN varies in degree and in kind according to its cause, intensity, and seat, it results from the pressure of the swelling on the nerves. Pain is not a constant sign of inflammation.

HEAT is due to the changes that are being undergone, for blood returning from an inflamed part has a higher temperature than that going to it.

SWELLING depends upon the congestion of the vessels and the exudation of liquor sanguinis into the tissues.

If a part has been in a state of inflammation it must have a termination or result, and these are Resolution, Adhesion, Effusion, Suppuration, Ulceration and Mortification or Gangrene.

RESOLUTION is said to result when the parts regain their normal condition.

ADHESION is where the exudate is not absorbed, but becomes converted into organized tissue as in pleurisy or interfering.

EFFUSION is where there is an escape of fibrin or its constituents, but it does not coagulate until exposed to the air. It denotes an ill-conditioned state of the blood.

SUPPURATION is when pus is formed; it may be circumscribed, diffused or superficial.

ULCERATION is death of a part in small particles.

GANGRENE, or Mortification, is death of a part either in its entirety or a portion of greater or less size; when this process commences it is called sloughing.

The terms ACUTE, SUBACUTE and CHRONIC have reference to the severity, duration, rapidity or slowness of its course. SYMPTOMS are of two kinds, LOCAL and CONSTITUTIONAL. The former has been described. The latter vary according to the severity of the attack and the organs or parts attacked. The temperature is increased. Normal in horse and ox, about 99 to 100, sheep a little higher. It is often ushered in by rigours, loss of appetite, excitability, followed by dullness. The secretions and excretions are impaired, the bowels costive and urine scanty. The pulse is accelerated; the normal number of beats in the minute in the horse is from 36 to 40, ox 40 to 50, dog 80 to 100 according to size and breed, sheep 70 to 80. The pulse of a young animal is more frequent than of an adult. The pulse felt by the finger is due to the fact that the artery expands during the contraction of the heart which forces the blood through the arteries, and returns to its previous condition during the relaxation of the heart. The pulse can be felt at any place where an artery runs close to a bone and is not covered deeply by muscles. In the horse and ox we get the pulse at the jaw (THE SUBMAXILLARY) or on the inner side of the arm (THE BRACHUAL). In the dog and sheep on the inside of thigh (THE FEMORAL). The pulse varies in character in different diseases, and is recognized by different names according to the impression it conveys to the finger.

FREQUENT and INFREQUENT as regards the number in a given time.

QUICK and SLOW, according to the time occupied by each beat.

LARGE and SMALL, according to dilatibility.

HARD and SOFT, according to compressibility.

In health there is a uniform relation between the number of pulsations and respirations, there are 3 or 4 of the former to one of the latter, but in disease we have various modifications of this rule.

TREATMENT.—Remove the cause, keep the animal at rest in a comfortable place, attend to its comfort according to the weather, give easily digested food and cold water AD LIB. Bloodletting, either local or general, is sometimes good practice. Sedatives, opiates, purgatives, diuretics, in first stages, followed by tonics. This is constitutional treatment. Local treatment consists of fomentations, hot or cold, anodyne or cooling lotions in first stages, followed by stimulants, afterwards by counter-irritants.

This, of course, is the general treatment for inflammation. We will consider as we go along, inflammation of different kinds and of different organs, the treatment of which varies to a great extent according to the organ involved.

DISEASES OF BONE.

Ostitis, or inflammation of bone, is usually caused by external violence or concussion, and is usually associated with periostitis. It may occur in any situation and may involve the whole bone but is usually confined to a portion ; may be acute or chronic.

SYMPTOMS.—Severe tenderness of the part. Lameness if a limb be the seat ; swelling, at first of a doughy character, but which soon becomes hard ; heat in the part.

TREATMENT. Rest, fomentations, anodyne or cooling lotions, followed by counter-irritation, or periosteotomy.

Prescriptions.

ANODYNE LOTION.

Tincture of Opium ...2 fluid oz.
Acetate of lead ....3 drachms
Water..........................8 fluid oz.

STIMULANT LINIMENT.

Alcohol ....2 fluid oz.
Oil of Turpentine ......2 fluid oz.
Liquor Ammonia Fortier ....2 fluid oz.
Water ....1 pint

LIQUID ABSORBENT BLISTER.

Biniodide of Mercury ......2 drs.
Iodide of Potassium......... 2 drs.
Water..........................8 fluid oz.

LIQUID BLISTER.

Powdered Cantharides......2 drs.
Alcohol ....4 fluid oz.
Water.........................4 fluid oz.

PASTE BLISTER.

Biniodide of Mercury ......2 drs.
Powdered Cantharides......2 drs.
Lard..................................2 oz.

AMMONIACAL LINIMENT.

Liquor Ammonia Fortier ....2 fluid oz.
Oil of Turpentine ......3 fluid oz.
Raw Linseed Oil.........3 fluid oz.

COOLING LOTION (White lotion)

Acetate of Lead ....1 oz.
Sulphate of Zinc...............6 drs.
Water..............................1 pint

COLIC DRENCH.

Tinct. Opium............1½ fluid oz.
Fluid Ext. Belladonna 1½ fluid oz.
Sweet Spirits Nitre ...1½ fluid oz.
Water..............................½ pint

CAMPHORATED LINIMENT.

Alcohol ....3 fluid oz.
Oil of Turpentine ......2 fluid oz.
Spirits of Ammonia ..1 fluid oz.
Gum Camphor..................4 drs.
Water to make.................1 pint

Sore Shins is generally seen in young horses, the result of fast work ; there will be great lameness and soreness to the touch, with heat and swelling in front of the metacarpals.

Treatment —Same as ostitis

Splints, or Splents, are exostosises resulting from ostitis, their usual situation being on the upper and inner part of the metacarpal, but are occasionally seen below or on the outside of the bone and sometimes on the metatarsal. Both the large and small bones are involved. (The tubercle on the small bone is sometimes mistaken for splint)

Symptoms.—Generally, but not always, lameness is present, and is of a peculiar character, the animal usually walking sound, or nearly so, but when trotted will go very lame. There will be tenderness to pressure over the part, and some heat ; after a time an enlargement can be noticed. Lameness, when present, is noticed during the first, or inflammatory stage, and,

unlike many other diseases, it increases on exercise. Splints often appear without causing any inconvenience, and when there is no lameness and the splint is not very near the joint it can hardly be called an unsoundness.)

Causes.—Usually due to concussion or direct injury (hereditary).

Treatment.—Same as for ostitis, sometimes the actual cautery or periosteotomy.

(In mostly all these bone diseases inflammation is set up by concussion or otherwise, between the bones, a deposit is thrown out which becomes ossified, the idea in treatment being to allay the inflammation and hasten on the process of ossification, when the lameness usually ceases.)

Caries is the death of a bone in small particles, being similar to ulceration of soft tissues. We have dry and moist caries, the former occurring in the articular part of a bone when not exposed to the atmosphere, and the latter in injured parts to which the air gains access. The dry form is noticed in spavin, ringbone, etc., and is curable only in the first stages, by rest and powerful irritation, which causes fresh material to be deposited, but if it has become at all extensive the breach will not be repaired in this manner and the only hope of removing the lameness is to produce Anchylosis ; this results from a quantity of material being thrown out, which ossifies and unites the bones together, thus doing away with motion and irritation. This, is of course, successful only in joints of inextensive motion. Moist caries occur in open joint, poll evil, fistulous withers, etc., giving rise to a fœtid odour from the discharge. It may be cured by scraping the diseased bone, or by applying dilute hydrochloric acid, etc.

Necrosis, or death of a bone in greater or less quantities, corresponds to gangrene of the soft structures, and is as distinct from caries as mortification is from ulceration. Some of the long bones have been known to become necrosed in their entirety and actually be reproduced, the new bone forming a sheath for the old, which escapes in small pieces from holes in the new bone.

Necrosis of a portion of a bone frequently occurs in our patients, a common seat of it being the lower jaw, caused by the curb chain.

SYMPTOMS.—First there will be a swelling of a doughy character, which soon becomes hard, finally bursting and discharging a fœtid pus. The opening does not heal, and if probed the probe can readily be felt grating against the bare bone. The part can be cut down upon and the diseased parts removed with a bone forceps, or scraped if the disease be slight, and the wound treated with carbolic acid, etc. This condition often results from injury to other bones and requires the same treatment.

Rickets, or Rachitis, are terms used to denote unnatural softness of the osseous system in young animals. It is noticed in foals, calves and puppies ; the long bones being bent in different directions, and sometimes the joints are enlarged, hot and painful. It is due to deficiency in the inorganic elements, and a want of power to assimilate them. If the animal lives, earthy matter is eventually deposited in them, they become firm but the curvatures remain.

CAUSES.—Constitutional debility, noticed in calves not allowed to suckle, and in foals when their mothers work.

TREATMENT.—Remove cause, support the bent limbs with splints and bandages, feed frequently a little lime water in the milk, attend to digestion, give a laxative, as a little castor oil and bicarbonate of potash made into an emulsion. Then give phosphate of lime, 5 to 10 grs., and iron sulphate, same quantities, or cod liver oil. If the milk be deficient in quantity or quality give linseed tea.

Mollities Osseum is not often seen ; there is complete absence of earthy matter, generally local ; cause not known.

Osteo Porosis.—Big head. Increase in size of bone without corresponding increase in weight. There is also brittleness, generally attacks the bones of the head, but sometimes those of the extremities. The vertebral column is also sometimes the seat of it. Cattle and

heep are sometimes attacked. The parts become swollen and painful to the touch. If the limbs be affected there will be lameness easily fractured ; causes not known, nothing can be done.

Osteo Sarcoma, Actinomycosis, is a tumour partly bony and partly fleshy, situated on either the upper or lower jaw, generally the latter, of cattle, due to a fungus. Has been said to exist in horses.

SYMPTOMS.—Slight elevation which gradually grows, painful to pressure, at the last it breaks and discharges a bloody matter ; may cause no inconvenience for some time, but eventually, in most cases, it interferes with mastication ; the teeth become loose and fall out.

CAUSES.—It appears to be hereditary. It is now considered to be due to the deposit of a fungus.

TREATMENT.—In the early stages the administration of Iodide of Potash, 1 to 2 dr. doses, thrice daily, may effect a cure.

Fracture is a solution of continuity of bone. It may take place in an oblique, transverse or longitudinal direction. A fracture is said to be SIMPLE when the soft parts are not injured, COMPOUND when there is an open wound communicating with the broken bone, COMMINUTED when the bone is broken into several fragments, COMPLICATED when there is serious injury to some adjoining structures, as laceration of vessels, open joint, or serious bruising of the tissues.

GENERAL SYMPTOMS.—When occurring in one or more bones of a limb, great lameness is suddenly manifested, obvious deformity (with some exceptions) preternatural mobility, crepitus, and inability to bear weight on the limb. (It is a popular error to think that the bones of our patients will not unite, as the progress of repair is rapid under favourable circumstances.) An early consequence of fracture appears to be an exudation of lymph, which after a time attains firmness, when it is called a callus. This is generally thrown out around the break, ensheathing it like a ferrule and is called provisional callus. Sometimes the new material is placed between the broken ends, glueing them together ; it is then called intermediate callus. In both

cases there is usually some reparative material deposited in the medullary canal receiving the name of interior callus. In a varying time these deposits become composed of ossific matter, in fact, regular bone, thus the breach is repaired. Repair of fracture by a false joint is an arrestment of the process before ossification commences.

Treatment.—Reduce as soon as possible to prevent bad effects of continued irritation, and before inflammation and thickening result, which would impede adjustment. Put in slings, apply splints and bandages. Do not use slings in foals or cattle. Apply plenty of cold water. In compound fractures the external wound makes serious differences in effecting a cure, as it is apt to cause violent inflammation and fever, terminating in profuse suppuration and gangrene. In such cases the external wound must be treated as an ordinary wound.

Dislocations without fracture are rare in our patients ; the most common form is that of the patella of the horse, the head of the femur and knee of the dog, and that partial form which may be said to exist in knuckling over at the fetlock of the horse. Dislocation or luxation of the patella occurs chiefly in young horses ; it is sometimes complete and sometimes partial, caused from slipping, walking on uneven ground, etc.

Symptoms.—In complete dislocation there is total inability on the part of the animal to flex the limb on account of the leverage being destroyed. The foot appears as though it were nailed to the ground. If the animal be forced to move the affected limb will be trailed along, the horse moving on the other three.

Treatment.—Attach a rope to the fetlock, and get an attendant to pull the limb forward ; press against the displaced bone with the ball of your hand and force the bone into place. If severe sprain or rupture of the ligaments have not taken place, the animal will now walk off sound. If rupture has taken place, recovery will be slow. If the luxation recur, as sometimes it will, it will be necessary to tie the affected limb forward, sometimes necessary to elevate the foot on a block of

wood or a stool and apply a blister to the inside and front of the joint. Animal to be kept in this position a few days.

Partial dislocation of the patella is that condition frequently seen in young animals, sometimes in old, when the patella slips partially out and in again with a clicking noise at every step. This is due to a relaxed condition of the ligaments; generally, a greater or less tumour is observed a little below the joint, called a porcellaneous deposit.

TREATMENT.—Keep animal as quiet as possible, and blister the joint on the front and inside repeatedly.

KNUCKLING over at fetlock arises from relaxation of the binding ligament, from overwork, etc. Sometimes seen in colts a few days old, occurring generally in fore legs.

TREATMENT.—In foals, use splints and bandages carefully adjusted. In grown horses it occurs usually in hind limbs from overwork, etc. Give rest and blister.

The head of the femur may become dislocated in the ox, dog and cat. In the horse this condition is impossible. Reduction is easily effected in the dog and cat by extension and manipulation; keep parts in place by pitch bandage. In the ox, treatment is not advisable, better slaughter.

SYMPTOMS.—Same as fracture, minus crepitation.

Dislocation of the knee or of one of the phalanges is common in running dogs. Reduction is easy, but the condition is apt to recur.

Dislocation of the Cervical Vertebræ without fracture may occur, when the animal's head will be found turned to one side and depressed, presenting a bony tumour on the convex side; may be able to walk with staggering gait and knuckling over at the fetlocks. When an attempt is made to straighten the neck, the animal often becomes paralysed, or it may cause death. If death does not result, the paralysis passes off when the pressure is removed. Treatment is generally useless. The animal may live and do a reasonable amount of work, but the neck will remain bent.

Twisting or Wry Neck may occur from a variety of causes, other than dislocation, such as bruising or overstretching the muscles on one side of the neck, or from rheumatic affection, inducing loss of function. This condition differs from dislocation in there being no paralysis caused when an attempt is made to straighten the neck.

Open Joint is caused by puncture or incision of the capsular ligament, or an injury that produces sloughing, allowing the synovia to escape. It usually causes little or no disturbance at first, but if air gains access, irritation is caused and in a period varying from two to ten days grave constitutional disturbance results; pulse becomes hard and frequent, acute pain is evinced by tremors and sweats on the body; lameness is excessive, the animal hardly being able to put the foot to the ground, but keeps it in a constant state of motion. There will be more or less swelling. The discharge of synovia may be trifling at first, but increases as the inflammation advances, coagulating on the lips of the wound and oozing through this or escaping in a stream when the animal moves the limb; there will be seen a thin, watery discharge, and small abscesses form around the joint. The fever, debility, emaciation, loss of appetite, etc., increase from day to day if the local symptoms be not arrested, and finally the animal dies of exhaustion. If the discharge becomes bloody, anchylosis will be taking place, and if the joint be one of extensive motion, the animal will be useless, and, unless valuable for breeding purposes, had better be destroyed.

TREATMENT.—If seen shortly after the injury, cleanse thoroughly, and if the wound be extensive, stitch carefully; fill with iodiform, cover with collodion and bandage. Give purgative, followed by diuretics; place in slings if necessary, and keep quiet. Don't remove the bandage for about ten days, when union by first intention will probably have taken place. If the injury has been received some time before treatment commences and suppuration has commenced, sling, purge, give opium if much pain, irrigate with cold water, apply cooling lotion, as white lotion. Some recommend blister, etc.; feed light for some time.

Lameness may be said to be an expression of pain in one or more limbs during progression. It is shown by the manner in which the animal stands, and in its gait. If standing, the position of one limb will usually be more upright than its fellow. One foreleg advanced in front of the other suggests some tenderness below the knee, particularly in the foot ; it is called pointing. Flexing backwards implies disease of the elbow or shoulder ; advance of both fore feet with hind feet well under the body, points to tenderness of both fore feet. The lame limb will be frequently elevated in the air in cases of extreme lameness. An inclination to lie much is also a symptom of lameness.

In EXERCISE, lameness may be shown in the walk ; but better in the slow, easy trot. If one fore foot be affected, the head and anterior part of the body are elevated when it comes to the ground, but drop firmly when the sound foot touches the ground. In lameness of one hind leg the gait resembles that seen in lameness before, the haunch on the diseased side being raised when the foot is planted, and allowed to droop until the sound foot touches the ground. In some cases the elevation is the prominent feature ; in others the depression ; but in all, the rising and falling are greater than in the opposite quarter. When lame in both fore limbs, the step is short, the stroke on the ground weak, the head is raised, the loins arched and the croop droops. Lameness in both hind limbs is marked by the backward position of the fore feet, the short rest on the ground of the hind, drooping of the head, and difficulty in backing. Lameness in two limbs on the same side produces a gait like the amble. When the cause of lameness exists in more than one limb, it is difficult to make the animal keep the trot. It is well in some cases that are not marked, to give exercise and then allow a few hours' rest before completing the examination.

In addition to determining the seat of lameness by the way the animal stands and moves, we can frequently arrive at a correct conclusion by making a manual examination, or by negative signs. If there be heat, pain and swelling in any part of a limb, discoverable

by the touch, the evidence is positive, and the cause of such lameness is in such a part; but if, on the other hand, there are none of these signs, we must conclude that it is deep-seated in the foot, or in a part thickly covered by healthy tissue, and we must arrive at a conclusion by negative evidence, assisted by peculiarities of gait. Lameness may be caused by a strain of a ligament, muscular tissue, or tendon, by fracture; diseased bone, cartilage, fibro cartilage, morbid condition of the skin, plugging of the arteries; accidents, as pricks in shoeing, treads, wounds, ulcers, rheumatism, and reflex nervous action, as in diseased liver.

A Sprain or Strain is violence inflicted upon a soft structure with extension and often rupture of its fibres. When a muscle is strained, the injury is succeeded by pain, swelling, heat, and loss of function. An inflamed muscle can no longer contract, hence in some strains the symptoms resemble those of paralysis. The swelling of an inflamed muscle is often followed by atrophy and sometimes by fatty degeneration of its fibres, the sarcous elements being replaced by glistening oil particles, so that the functional power is completely destroyed. These conditions are often due to an inflammatory exudate pressing upon the tissues and interfering with nutrition, and for this reason the sooner the exudate is removed the better.

TREATMENT.—Rest, soothing applications, followed by stimulants or blisters, purgative and cooling diet, followed by good nursing.

DISEASES AND INJURIES TO THE FORE EXTREMITY.

SHOULDER SLIP OR SWEENEY, is of common occurrence. It is in the first stage a sprain of the muscles of the shoulder, the antea and postea spinatus, teres externus and somtimes the flexor brachi, causing inflammation and swelling which interferes with nutrition of the part, causing atrophy or wasting away of the muscles. This same process may take place in any muscle but the ones mentioned seem to be particularly prone.

SYMPTOMS.—The shrinking of the muscles is generally the first thing noticed. There may be lameness

shown, the foot being brought forward in a rotatory motion. A hollow will be very noticeable on each side of the scapular spine. In extreme cases the shoulder joint will be seen to slip forward and backward, as it were, at each step, hence the name. It is oftenest seen in colts when just broken, especially if used in the furrow to the plough, due to walking on uneven ground.

TREATMENT.—Recovery is slow; give long rest, blister the shoulder repeatedly or apply a strong stimulant liniment. The insertion of setons acts more energetically, and may succeed when blisters fail; avoid working to plough.

Enlargements on the Shoulder are common in farm horses, usually the result of an illfitting collar. They vary much in character. When they are soft and fluctuating, and have made their appearance suddenly, they contain serum, and are called serous abscesses. If not attended to, the serum becomes converted into pus, they become hard around their circumference and soft in the centre, where the hair falls off. In some cases the walls become so thick as to give the impression of it being a solid mass. We frequently find growths in this region without well defined borders; they are fibrous in character, and consist in hypertrophy of connective tissue and are called fibrous tumours.

TREATMENT.—If fluid be present open up at most dependent part, syringe out the cavity twice daily and inject an antiseptic lotion, as white lotion, carbolic lotion, etc. Keep wound open until the cavity is healed, might insert a piece of tow or a seton. If there be a tumour without pus or serum dissect carefully out, stitch the wound, leaving a dependent orifice and treat as above.

Collar Galls, due to ill-fitting collars, working in hot weather, etc., are often seen. They are merely inflammation of the skin in different stages, and are often raw. In some cases the skin loses its vitality in a round patch, the outer portions of which are detached, but attached in the centre by living tissue.

This is called a SITFAST. They may occur in other parts from similar causes, the back being the most common seat.

TREATMENT.—Remove cause, bathe well with cold water and apply white lotion. Sitfasts must be removed with the knife.

Shoulder Lameness is comparatively RARE. The seat may be in the joint, or in connection with the flexor brachi, affecting the bicipital groove. Inflammation of the joint is the most serious, for if change of structure results the lameness will be permanent. A severe sprain of the muscles may affect the groove and cause permanent lameness.

SYMPTOMS.—Difficulty in extending the limb. It is brought forward in a rotary manner, best marked in the trot. Stands with limb flexed but foot not pointed. In some cases heat and swelling can be detected, especially in sprain of the flexor brachi; manipulation, extending and flexing the limb will cause pain; a sort of dragging gait.

TREATMENT.—It makes little difference whether in joint or muscles, give rest, take off shoe. If very severe, place in slings, foment, use camphorated liniment or freshly-flayed sheepskin, followed by blister. Setons are useful (put in three). If anchylosis takes place destroy the animal unless valuable for breeding purposes.

Elbow Lameness occurs from disease of the joint, sprain of the lateral ligaments or of the extensor brachi muscle. The internal lateral ligament may be sprained or ruptured by the fore-leg slipping outwards, the triceps by the leg slipping forwards. These accidents commonly occur in frosty weather. Cattle are very liable to these injuries. When the ligaments are sprained or the triceps injured diagnosis of the seat of lameness is easy, as there will be swelling, heat and tenderness of the parts, in addition to the difficulty in moving the articulation. The diagnostic signs of the joint lameness are the semi-flexed position of the leg while standing, and the excessive dropping of the head and the anterior parts of the body during action.

TREATMENT.—Rest, purgative, low diet, fomentations, liniments, followed by blisters.

Capped Elbow (Shoe boil) is a tumor on the point of the elbow, caused by the animal lying with the elbow on the heel of the shoe ; may consist of a serous abscess or be a fibrous tumour.

TREATMENT.—If abscess, open, if tumour, dissect out. A small wound on the point of the olecranon often gives rise to peculiar and alarming symptoms ; during motion the air is, as it were, pumped into the subcutaneous tissue, inflating it first in the neighbourhood of the wound, extending to a greater or less extent over the body. The head becomes enormously enlarged, eyelids swollen and closed, nostrils so much so as to interfere with breathing ; a crackling sound will be heard when the hand is pressed over the parts. This condition is not serious. Plug up the wound with tow dipped in collodion and keep quiet ; in a short time the air will be absorbed and the swelling disappear. If in danger of suffocation, puncture the skin in the region of the nostrils and press the air out with the hand.

The bursæ in the neighbourhood of the knees are liable to distension with synovia from injury to the tendons or from an over secretion of synovia. When arising from disease of the tendons it causes lameness, but from the latter cause no lameness will be present. The distension of the bursæ of the flexor pedis perforans muscle is called thoroughpin of the knee. The bursæ of the extensor metacarpi magnus sometimes becomes greatly distended, constituting what is called capped knee. When first observed there is generally some stiffness and pain showing that more or less inflammation is present. The symptoms should be combated by purgative, fomentation and rest, after subsidence of inflammation there is a fluctuating swelling. It may be punctured, or the fluid drawn off with an aspirator, followed by a blister, or it may be reduced by an absorbent. Puncture at the lowest margin of the inner side, so as to blemish as little as possible. Keep wound open with tow and bandage with flannel. Horned cattle, especially those kept tied, are liable to

have enormously distended knees from the distension of these bursæ, caused by bruising by lying on the hard floors. They may be opened with safety, and the best way is to insert a seton right through the substance of the swelling and allow it to remain in 3 or 4 weeks and pad the knee to prevent further injury.

Carpitis (inflammation of the knee joint) gives rise, in many cases, to a form of occult lameness, because there is often no external symptom of disease. Inflammation is set up in the bones, which if not arrested runs on to caries.

SYMPTOMS.—The animal may go sound at first but soon becomes lame on exercise, will show little lameness when walking, but great lameness when trotted, great disinclination to canter, the limb is moved with a circumductive motion outwards, and the knee is a little bent but not dragged as in shoulder lameness. These are the symptoms when lame in both legs. When in one leg the step is longer than that of the sound leg, there is expression of pain when the lame limb is flexed or extended. In some cases there is an exostosis which is usually situated on the inside.

TREATMENT.—Rest, low diet, purgative, fomentations, liniments, followed by blisters repeated, or in some cases the actual cautery.

Speedy Cut is the name given to an injury on the inner aspect of the metacarpal or the carpus, which often causes lameness. The injury is caused by the horse striking the part with the opposite foot.

SYMPTOMS.—Swelling and heat of the part, sometimes lameness ; the swelling may consist of a serous or purulent abscess.

TREATMENT.—If serum or pus be present lance and treat as an ordinary abscess, rest, purge, etc. If thickening remain apply a blister, repeat if necessary. Horses predisposed to speedy cut can often be helped by careful shoeing.

Broken Knees are caused by the horse falling on account of tender feet, slipping, careless driving, striking, fits of vertigo, etc. (It should be considered

unsoundness.) They are of 5 kinds, viz., 1st, skin bruised but not cut; 2nd, skin cut; 3rd, the tendon of the extensor magnus exposed and its bursæ opened; 4th, wound penetrating through the tendon exposing the articulation; 5th, one or more bones fractured.

Treatment.— 1st form. Rest, tie head up, bathe with cold water and apply white lotion for a few days. 2nd form. Bring edges of wound together by plaster (do not stitch), tie head up, bathe and dress with white or carbolic lotion. Of course all foreign bodies must be removed at first. 3rd form. In this form the swelling is sometimes extensive both above and below, and synovia escapes (not true open joint). Remove all foreign bodies and lacerated or partially detached tissue, give purgative, and treat as above. 4th form. If the tendon has been crushed, although neither lacerated or divided, it may slough in a few days, its vitality being destroyed. Severe constitutional symptoms may be presented; when the slough is removed the articulations are exposed. The power of extension is now lost and the limb is persistently flexed. In such a case it is better to destroy the animal unless valuable for breeding purposes, as anchylosis will be the result. If treated the animal must be placed in slings and the limb kept straight by splints and bandages, the knee being left bare; use irrigation, lotions, etc. 5th form. Destroy the animal.

The causes of lameness now to be described, extending to the foot, are mostly common to both fore and hind limb. When such is not the case special reference will be made to them. They may be enumerated as follows:

Sprain of the Flexor Tendons. The so-called sprain of the back sinews is not primarily in reality a lesion of the flexor tendons proper, but consists of a diseased condition arising from over-extension of the metacarpal or metatarsal check ligaments situated below the knee and hock. These ligaments arise from below the upper extremities of the metacarpal and metatarsal bones and run down the leg posterior to the suspensory ligament, become attached to the perforans tendon half way down the leg, and are placed there to prevent

over extension of the tendons. This lesion more often occurs in cart horses from high calkins on toe. The ligament becomes shortened from the swelling, preventing the heel from touching the ground.

Symptoms.—At first heat and swelling, pain on pressure, the tendons sometimes become involved from the extension of the inflammation; more or less lameness will be shown. To detect slight sprain, compare limbs, it is difficult in heavy-limbed horses.

Treatment.—High-heeled shoe to throw the stress off the tendons, a long rest, and repeated blistering; when shortening has permanently taken place tenotomy may be performed.

Sprain of the Suspensory Ligament, or breaking down, is of two kinds, viz., an inflamed condition arising from a more or less severe sprain, and secondly, rupture, either partial or complete, from more violent causes.

Symptoms.—In first form, lameness, pain on pressure, and there may be more or less swelling. In the second form, in addition to these symptoms the fetlock pad will descend more or less, according to the severity of the lesion. The rupture may be completely through the substance of the ligament above its bifurcation, or only one of its branches, or it may be detached from the sesamoids without rupture. The lameness is often very great. The marks of the lesion always remain in the shape of a thickening.

Treatment.—Slings, firm pledgets of tow bandaged in the hollow of the heel to support the fetlock; irrigation and stimulant liniment, followed by blisters to remove thickening. In many cases of injury to the foot the absorbents of the leg become swollen and inflamed. This must not be confounded with tendinous or ligamentous injuries.

Sprain of the Fetlock Joint is rare in comparison to other forms of lameness; lameness in the foot is often mistaken for it. It is generally one of the lateral ligaments that is sprained. It may be here observed

that squareness of the fetlock, obtained by well developed tuberosities on the ossuffraginis, is much to be desired, a round fetlock being very objectionable.

In inflammation of the fetlock, from whatever cause, the lameness is characterised by, on the part of the animal, inability to flex it, by heat and swelling (sometimes not well marked), pain on pressure or on manipulation by flexing, twisting, etc., and more or less pointing of the foot.

TREATMENT.—Rest, box stall, cold or warm water, stimulant liniment, bandage, followed if necessary by blister.

Sesamoiditis.--Inflammation of the sesamoid bursæ. The posterior part of the sesamoid bones is covered by cartilage forming a groove over which the flexor perforans plays. Both the cartilaginous pad and the tendon are liable to injury which causes severe and obstinate lameness. It may arise from injury to the suspensory ligament by the extension of inflammation, and is oftener met with in hunters than any other class of horses. This lesion is more often seen in the hind than the fore limbs and is often difficult to diagnose, owing to the swelling being slight.

SYMPTOMS.—Lameness, going on the toe unless the suspensory ligament be involved; heat and tenderness at the fetlock with swelling of the bursæ, the swelling being different from mere wind-gall (dropsy of bursæ); although it fluctuates upon pressure it feels tense, whereas in common wind-gall it is soft and easily moved from one side to the other.

TREATMENT.—If lameness be very severe place in slings, apply high-heeled shoe, constant application of cold water, stimulant liniment, followed by blister

Ring-Bones.—This term is applied to the osseous deposits which are found upon the upper and lower pastern bones. They are of two kinds, viz., true and false. False ringbones is an exostosis situated about the middle of the os

suffraginis not involving a joint or causing lameness unless very large. True ringbone is one which involves a joint. We have two forms of this, viz., the high and the low, high when the pastern joint is affected, low when the coffin. Whether high or low they vary in size. The degree of lameness does not depend upon the size of the deposit, sometimes great lameness from small deposit and vice versa. Very often the segment of the ring is defective and the deposit may appear only on one surface of the bone, or on both sides without any prominence in front, or it may extend all around. When the sides only are affected there is seldom the same degree of lameness as when the front is involved. They are not the cause, but the result of disease, being the effect of inflammation originating in the bones. The lameness of ringbones usually precedes the deposition of bony matter and is due to the process of inflammation in the bones or synovial membrane. It always, or nearly always, causes lameness at the commencement, but when anchylosis is completed the lameness may almost or entirely disappear. The causes of ringbone are hereditary, structual, incidental and rheumatoid. There is no doubt about hereditary predisposition, therefore I advise breeders to be very careful in selecting sires and dams, and not breed an animal that has ringbone unless its origin can be clearly traced to incidental causes. The structural tendency is manifested in horses with upright pasterns, as they receive weight in a direct line; they occur more frequently in the hind pasterns. The lameness of ringbone at first is often very irregular. In the treatment of ringbone observe how the animal puts the foot to the ground; if the first toe, put on a high-heeled shoe, and vice versa. Horses with very long pasterns are also liable, from the fact that they act too powerfully as levers upon the articulation. In such cases they probably arise from sprain of the ligament.

Treatment.—Long rest, blisters, actual cautery, followed by blister, sometimes necessary to fire a second time. Lameness often persists for a long time after treatment. If this treatment fails perform neurotomy.

Particular Lamenesses (Hind Extremity).

(**Hip Joint Lameness** is rarely met with except as a result of scrofulous diathesis in young animals and of rheumatism in those of mature age. Sprain of the hip joint is very rare, but it may occur. The same pathological changes are observed as in other joints, viz., redness of the synovial membrane, exudation into the cavity, and if not arrested, ulceration of the articular cartilage and laminar layer of the bones. In rheumatoid disease the tendency is to the formation of the porcellaneous deposits within, and bony vegetations around the articulation.)

Lameness in the hip, however, is not an unfrequent occurrence, still its seat is not the joint but the head of the trochanter major of the femur, over the convexity of which plays the tendon of the GLUTEUS MAXIMUS. Violent inflammation of the hip joint is accompanied by very severe symptoms; the animal will stand almost immovable with the foot raised from the ground, all movements causing great pain. There will be fever, loss of appetite and flesh, rapid wasting of the quarter, and inability to lie down. In such cases the animal must be placed in slings. The symptoms of a mild form of hip joint or trochanteric lameness do not differ in any peculiarity of gait. There is a hop and a catch in the lame limb, and a want of movement in the quarter. The quarter of the lame side is elevated as little as possible, the other articulations being flexed with ease. In some cases heat may be elt and pain caused by pressure applied per rectum. In trochanteric lameness a distinct swelling can be detected both by touch and sight upon the quarter. In both forms atrophy of the muscles of the quarter soon appears. (May be mistaken for fracture, one gradually atrophies, the other falls in at once.)

In the TREATMENT of either form the high-heeled shoe is to be put on the foot, to enable the parts to be kept in a state of repose. Long rest is required, as the lameness is apt to return, and in this, as in other lamenesses, treatment should be resorted to before alteration of structure has taken place. Even when all lameness has disappeared great care should be taken to not put the animal to work too soon.

Sprain and Atrophy of the crural muscles. This mass of muscles consists of the rectus femorus, vastus externus and internus, and the crureus. The muscular structure is intimately connected and becomes attached to the superior surface of the patella; their action is to extend and elevate the thigh and advance it under the body.

Symptoms are inability to extend the stifle and flex the hock, in fact, to draw the limb forward, dragging of the toe when the patient moves. After a time atrophy takes place and a concavity presents itself between the anterior spine of the ileum and the patella

This form of lameness requires a long rest with blistering.

Stifle Joint lameness is of two kinds, viz., that within the joint proper and that in the patella articulation. The pathology of both forms is alike, inflammation, ulceration of the articular cartilage and semilunar discs, when the joint proper is involved. Of the deposition of the porcellaneous deposit, both in the cartilage and Haversian canals of the bone when caused by rheumatic disease. In this lameness, the limb, when the animal stands, is generally bent, the thigh flexed upon the pelvis and the leg upon the thigh, so that the articular surfaces of the bones are separated and prevented from pressing against each other, but when made to move the relative positions of the bones are altered, and instead of being flexed the stifle is maintained in a rigidly extended state. In lameness from disease of the bursæ-patella, the horse generally walks with his toe dragging the ground, but this is not a constant symptom, as in some well marked patella lameness the heel comes first to the ground. There is a swelling in front of the joint, which must not be confounded with an apparent enlargement of this part seen in the healthy stifle when the animal stands with the limb in a semi-flexed easy position. The swelling arising from disease, is persistent, hard and prominent when the limb is extended; but the enlargement when resting, in the healthy joint is soft, and disappears when the animal is made to move or stand firmly.

The muscles of the stifle are subject to cramps, the symptoms being the limb extended and fixed to the ground. It comes on and goes off suddenly. Such cases sometimes arise from indigestion, and the liability to return is removed by a physic and tonics.

Laceration of the flexor metatarsi muscle sometimes occurs. It is attached to the external condyle of the femur superiorly, inferiorly to the metatarsal.

Symptoms.—The limb is drawn up and back and the gastrocnemii muscles thrown into a relaxed condition. They sometimes make good recoveries if the muscles be not too greatly torn and the animal be not old. Long rest is required along with local stimulants or counter irritants.

Diseases of the Hock may be divided into three classes, viz., (1) Diseases of the true hock joint (that composed of the tibia and astragalus). (2) Diseases of the gliding articulations formed by the cuneiform bones; and (3) Diseases of the ligamentous and tendinous attachments.

Bog Spavin, when caused by inflammation of the joint, is a tense fluctuating swelling in front of the hock, accompanied by heat and pain. In such cases it is an unsoundness, indicating a change within the textures of the joint. There are bog spavins, however, which may not be looked upon as constituting unsoundness, being mere dropsy of the articulation arising from some fault of conformation. This kind is most frequently found in very upright or very crooked hocks and in a weak hock of any description, because in all these forms concussion is most severely felt and exertion is likely to be injurious. It may be acute or chronic. In the acute form lameness is very great, with fever, loss of condition and inability to put the foot to the ground. In the chronic form the symptoms are not so severe, but the terminations of both are often unfavourable.

Treatment.—If lameness is very severe place in slings (seldom necessary). Allay inflammation by the application of cold, and anodyne lotion, follow up by pressure applied by bandage or truss; or by blisters repeated.

What is termed **Blood Spavin** is simply a distended condition of the Vena Saphena caused by bursal or bony enlargement.

What is commonly called **Spring Hock** is an enlarged and inflamed condition of the tarsus generally, involving the structures of the whole articulation, arising from severe sprain, sometimes pus is formed, and sometimes there is fracture of one or more bones. This injury causes intense pain and severe lameness, fever, and rapid loss of condition, prevents the animal from lying down, and sometimes causes death.

Treatment.—Place in slings, give laxative and febrifuges; hot fomentations or poultices to the part, anodyne lotion. If pus form, open and allow its escape. After the acute symptoms have subsided repeated blistering to stimulate the absorption of the callous enlargements; setons or actual cautery may be used instead.

Diseases of the Gliding Articulation.

Bone Spavin is a very common cause of lameness and unsoundness. (It is important that a man should be a good judge of a hock, for what may be a spavin in one horse may be merely a peculiarity of conformation in another.) A bone spavin may be defined as an exostosis, generally situated on the antero-internal and lower part of the hock, arising from inflammation of the cuneiform and metatarsal bones, terminating generally in anchylosis of one or more of the gliding joints of the hock. It is rarely seen on the outer side, as the inner side is more under the centre of gravity.

Occult Spavin is when the true hock joint is affected, in which case no enlargement can be detected.

Causes.—Hereditary predisposition and local causes. Hereditary from conformation, but it may arise from ossific diathesis. The local or exiting causes are sprain of the ligaments, more particularly the interosseous. and concussion of the bones. It is often attributed to injury by sellers, but is very unlikely to thus occur. It is the result of hard and fast work. Young animals most subject.

Symptoms.—(The examiner should be a good judge of a sound hock.) Prominence of the cuneiform bones should not be mistaken for spavin. Compare hocks, coarse hocks, if alike, should not be condemned. Look for enlargements, which are generally easily detected. If in first stages there may be no enlargement, the disease being confined to the articular surfaces; must then judge by action. To detect exostosis examine both hocks with fingers; good practice to dampen and smooth the hair; view from behind and from before. Taking front view, have an assistant hold the tail to one side, and look backwards between the fore legs and carefully compare the hocks. If of long standing, and lameness be present, there will be wasting of the quarter. The lameness of spavin is generally characteristic, the animal going very lame and going on the toe for a few steps, and then going better, or almost or quite sound until let stand again; he will often rest the limb when standing. In the morning after he has been in the stable all night, if stood over in the stall he will show the lameness plainly, if walked will step on toe and take short steps, if lame in foot will take long steps.

Negative Symptoms will help to diagnose. If the hock be forcibly flexed and the horse immediately walked off, lameness will be shown if spavin be present.

Treatment.—Rest, blister, actual cautery, followed by blister; sometimes necessary to fire twice.

Thoroughpin is a bursæl enlargement situated on the supero-posterior lateral parts of the hock, arising from disease of the flexor pedis perforans muscle, which is enclosed by a synovial sheath on the inner side of the os calcis, or from dropsy of the sheath without disease of the tendon. The fluid which fills it may be pressed from side to side, hence the name thoroughpin. It is often associated with bog spavin. It is usually found in short, fleshy legged horses with upright hocks where the os calcis is short and ill developed.

Treatment.—Same as for bog spavin. Some recommend puncturing for either disease but it is a dangerous practice.

Capped Hock is of two kinds, viz.: synovial and serous. The former appears as a tense, fluctuating swelling, situated upon both sides of the point of the hock. It is an unsoundness, causing lameness and sometimes the formation of abscesses from caries or necrosis of the summit of the os calcis. Serous capped hock is a serous abscess on the point of the hock, caused by pressure or violence. It is situated in the areolar tissue between the skin and tendon. It is not considered an unsoundness if not causing lameness, and usually arises from the horse striking the point of the hock against some hard substance.

TREATMENT.—If slight, cold and absorbents. If large and serous, open and treat as ordinary abscess, but if synovial be careful about lancing. Remove cause and apply absorbents or blisters.

Displacement of Tendon of Gastrocnemius Internus is a rare form of injury, but does occur from animals kicking violently and destroying cohesion of slips of insertion and allowing tendon to slip to one side. Treatment consists in throwing the part into a state of repose by high heeled shoe, cold water and after the inflammation has subsided, blister or fire.

In injury to the gastrocnemii muscles the foot is elevated from the ground, as in string halt, the leg being suddenly brought upwards and forward at each step; when standing still knuckling at the fetlock joint. Division of the tendon Achilles is called "ham strung," and when such an injury is inflicted the fetlock pad is brought to the ground and the limb is powerless. Such cases sometimes do well when the leg is fastened to a splint extending from the foot to the stifle and bandaged.

Curb is a sprain of the calcaneo-cuboid ligament. It can be easily recognised as an enlargement on the back of the hock from 4 to 5 inches below the point. Hyper development of the cuboid bone must not be confounded with curb. Curb is apt to cause lameness in young horses, or when of recent origin in horses of all ages. If of long standing there is seldom lameness and it is considered by some not to be an unsoundness. What

are called curby hocks are over bent or sickle shaped, and if associated with long calces are almost sure to become the seat of true curb.

Treatment.—Rest, high heeled shoe. Reduce inflammation by hot or cold applications, followed by repeated blistering or actual cautery.

Severing of Back Tendons may occur in either fore or hind limbs, more frequently in hind, from accidents, as runaways, etc. If both tendons be severed the fetlock pad will come to the ground and the toe turns up at every step. If but one be severed these symptoms will be presented in a less marked degree.

Treatment.—Place in slings, get a shoe made long and high at the heel with upright behind reaching to hock, pad so as to not scarify, and fasten firmly to metatarsal below the hock ; apply cold water and white or carbolic lotion. A good recovery will generally result.

General Treatment of Lameness. Before describing the diseases of the foot, which are so numerous and important as to require special consideration, I will endeavour to give a brief description of the treatment of lameness. Make a correct diagnosis, remove cause if possible, shoe in a manner to give rest and place the part in a state of repose. In all severe cases subdue inflammation before any organic change takes place which may render the case incurable, or curable only by a lengthened state of repair. For reduction of inflammation hot or cold applications to the affected part are very useful ; hot are more soothing, and where there is much pain are preferable ; cold will reduce swelling more quickly and may be used after acute pain has subsided. Poultices, either hot or cold, are useful. Astringents, as white lotion, or acetate of lead, 1 oz., alcohol, 2 fluid oz., water, 1 pt., bandages to promote absorption of exudate. Local bleeding is not often advisable but may sometimes be attended with benefit. Purgatives are useful in the first stages followed by diuretics and febrifuges. Restricted diet, as bran and a little hay ; after the acute inflammation has subsided if lameness remain counter-irritation will be necessary. They consist of rubefacients, blisters,

setons and the actual cautery. The action of these remedies differs only in degree, in rapidity and in prominence, and not in the nature of the exudation they produce. As the name indicates, it was originally thought that no two inflammations could exist at the same time in the body, and that by producing superficial inflammation the internal would be relieved. But it is now generally considered that they produce a a reparative inflammation which excites the formation of a reparative material by which breaches are united, ulcers healed and diseased action removed.

DISEASES OF THE FEET.

To prevent diseases of the feet great care in shoeing is necessary, the object being to keep the feet in as natural a position as possible.

The diseases of the feet may be arranged as follows: First, diseases of bone and cartilage. Second, those originating in horn-producing structures. Third, accidental injuries. We sometimes get lameness from diseases of the PYRAMIDAL PROCESS, caused by injury or blows on the front of the coronet, or from over-tension of the extensor tendon from the use of high calkins.

SYMPTOMS.—Swelling in front of the coronet from the size of a hazel nut to a pigeon's egg, with lameness, which is often persistent. When moving he puts the heel down first, and quickly picks the foot up when the toe touches the ground. Pain on pressure and more or less heat in the part. Occasionally the skin over the part sloughs, leaving a wound which is often difficult to heal. Or a wound may be present from the first if the injury be due to violence.

TREATMENT.—Rest, low-heeled bar shoe, fomentations, poulticing, succeeded by blisters or actual cautery.

If the sore assumes an unhealthy character we frequently have to apply caustics, as the butter of antimony applied with a feather once or twice. In some cases the lameness resists treatment, found to be due to caries, which spreads to the joint. In such cases neurotomy may be performed if the foot be good and strong.

Ossification of Lateral Cartilages.

This is called SIDE BONE, and consists of conversion into bone of the lateral cartilages. It is most commonly met with in heavy horses and in the fore feet. The process is often a slow one and accompanied by little or no pain and causing no lameness, but occasionally we have lameness. The causes are hereditary tendency, and shoeing with high calkins. In light horses this condition is more serious, as they cannot stand fast work when so affected. In the healthy foot the cartilages can be easily felt, and when pressed they yield readily, being naturally elastic, and immediately resume their normal position on the pressure being removed. When diseased they lose this character, become hard and unyielding, and they also become enlarged considerably and can be easily seen.

TREATMENT.—Rest, bar shoe, blisters, actual cautery, and, if these fail, neurotomy.

Navicular Disease.

This is commonly called COFFIN JOINT lameness and is the most fertile cause of lameness in the fore feet of our better bred horses, and the symptoms are very obscure. At one time mostly all cases of obscure lameness were attributed to shoulder trouble, but after the discovery of this disease by James Taylor, all were said to arise from navicular disease. It consists of inflammation set up in the parts, usually from concussion, the cancellated tissue of the bone being usually affected, causing absorption of the articular lamellæ and articular cartilage, which is often followed by adhesion of the tendon to the bone, and sometimes degeneration of the tendon and consequent rupture. It is due to rheumatoid diathesis and concussion; is often caused by using high-heeled shoes, which increases concussion by altering the position of the navicular bone, causing it to have more weight than nature intended. May be caused by pressure of a stone in the foot, or by hard and fast work on hard roads; or may result from severe sprain of the joint, or from irregular exercise and standing upon hard, dry floors a great deal.

Symptoms are negative and positive. The negative symptoms are the absence of disease or injury in any part of the limb. This limits the trouble to the foot. At first the lameness of navicular disease is very irregular, one day the horse will go slightly lame, the next possibly go sound, and again go more or less lame, and so on. After a time the lameness becomes more constant, and the horse usually points the foot when standing. This is a useful symptom when combined with others in diagnosing this disease, but must not be depended on too much as the horse may point the foot from other diseases, as ringbone, sprain, splint, etc., or an animal may point the foot from mere habit when he is entirely free from unsoundness, or he may point from fatigue, first one foot and then the other.

Positive Signs.—There may be heat and tenderness in the hollow of the heel, but this is not a very constant or reliable symptom as the parts are so deep seated we cannot always detect heat or tenderness, and if you press sufficiently hard on that part of any horse he will flinch. A horse suffering from this disease usually comes out of the stable very stiff and lame, steps short and groggy; after being exercised for a time, especially if the ground be soft, the great lameness disappears. If he be affected in both feet his step is short and stilty and he appears to be rigid and bound by some stiffness of the muscles of the chest and shoulders. On this account our forefathers called the disease chest founder. There is no actual disease of the muscles, but we observe an atrophy or shrinking from diminished functions.

Contraction of the feet succeeds navicular disease. If but one foot be affected it will soon be noticed that that foot is smaller than its fellow. The animal strikes the ground first with the toe consequently wearing the toe of the shoe more than the other parts and he is inclined to stumble.

Treatment.—In the first stages, the disease being that of inflammation, means should be taken to arrest this process before alteration of the structures of the parts occurs. Give rest, remove the shoes, pare

the foot well down at the heels, stand in a tub of cold water during the day, apply a poultice at night, and place in a nice box stall well bedded to encourage him to lie down. In about a fortnight it is well to apply a blister around the coronet, whether the lameness be removed or not. If this treatment fail to effect a cure a frog seton may be inserted and allowed to remain for 4 or 5 weeks. If taken in time the above treatment will usually effect a cure, but if the disease be of long standing and the bone and tendon have become diseased and adherent we can readily understand that a perfect cure cannot be effected. If we fail to cure by these means further treatment will be useless and the animal must be put at slow work or neurotomy be performed to remove pain. (This does not cure the disease.) The untoward results of the operation are fracture of the bone, rupture of the tendon, sloughing of the foot, a peculiar gelatinous degeneration of the bursæ and surrounding structures; the symptoms of the latter are a bulging, doughy, elastic swelling in the hollow of the heel, and the animal going on the toe.

Laminitis or inflammation of the Feet, or Founder, is of two kinds, viz., inflammation limited to the sensitive laminæ and sole; and ostitis, or inflammation involving the os pedis, laminæ and sole from the very outset. The causes, course and tractability of the two forms differ, but the first, if not subdued in a short time, is apt to become developed into the latter.

It is one of the most painful diseases the horse is liable to. It is caused by over-exertion, inordinate feeding, drinking cold water when heated, long voyages, from being compelled to stand for a long time in a constrained position, or a sudden chill. It is often communicated to the feet from internal organs, as from pneumonia, enteritis or bronchitis. In this case the feet are affected as well as the whole surface of the body, the hair of the mane and tail being often thrown off. Laminitis arising from over-exertion and from concussion by travelling on hard roads is much more intractable than when it appears during diseases of the mucous membranes when it may

pass off as a mere congestive attack without leaving any structural change; whilst the form caused by concussion leads to ostitis of the most acute kind, sometimes terminating in necrosis of the pedal bone, sloughing of the hoof and a most agonizing death. In some cases not quite so severe as the last, the os pedis becomes separated from the walls and forces the sole down, causing a convex sole which becomes thin and weak or degenerates into cheesy and spongy matter affording but little protection to the sensitive parts beneath. The wall becomes ribbed, that is, marked with transverse rings, which differ from the healthy rings.

Acute laminitis terminates in resolution of the parts, or in that form which is termed subacute, or chronic, in suppuration and occasionally gangrene.

Chronic laminitis is that condition of the feet remaining after the subsidence of fever, or it may originate independently of an acute attack. Horses suffering from the chronic form are subject to an acute attack from the most trivial cause, and the acute form when caused by concussion frequently degenerates into the chronic. Generally the disease is confined to the two fore feet, especially when caused by concussion, but it is not unusual to find all four feet affected, sometimes the hind feet only and rarely one fore and one hind foot. When one foot only is affected it is due to an injury to the opposite foot or limb which compels the animal to throw all the weight of that part of the body on the sound foot. In such a case the animal will suddenly be observed to throw his weight on the originally lame limb, although the wound, open joint, or whatever is wrong, still be present in all its severity.

Symptoms of inflammation of both feet. The horse is excessively lame, almost immovable, seems as if his body were cramped, stands with his hind legs drawn under his belly and his fore feet advanced; sometimes sways himself backwards, elevates the toes, throws his weight on his heels for a moment and then assumes his original position. He will often groan from pain, and sweats bedew the body. To diagnose

a case quickly the best method is to push the horse backwards, when he will elevate the toes and throw his weight on the heels. The pulse is full and strong. In some cases he will lie down on his side, with the legs stretched out, which seems to give great relief, whilst in others, especially in the earlier stages, he persists in standing. When the hind feet are affected the patient stands with all his four feet close together. The sufferings are even greater when the hind feet are affected, and the pain is distressing to witness. The animal stands "all in a heap," with anxious eyes, now nervously elevating one foot and then its fellow. The respirations are hurried and nostrils dilated. When all four feet are affected the symptoms will be a combination of the foregoing, with local heat in all the feet, some degrees of throbbing in the plantar arteries, and tenderness upon manipulation or to the touch of the hammer.

TREATMENT.—Gentle purgatives, enemas if the bowels be loaded, sedatives, as tincture of aconite, 10 to 20 drops repeated often. Remove shoes, pare heels and sole well down, apply heat to the feet, as poultices, or stand in warm water, and if he will not lie down it is good practice to throw him. After a few days, when the acute inflammation has ceased, apply cold to the feet or stand in cold water. If he persists in lying he must be turned occasionally; if unable to urinate the catheter must be used. After a few days get him shod with bar shoes and give gentle exercise. If tenderness threatens to remain blister around the coronet.

False Quarters consists in one or more clefts or fissures in any part of the crust or wall of the foot, due to the destruction of the secretory coronary band. The horny wall or crust of the foot being secreted by the coronary substance, it naturally follows that if any part of it be destroyed, the part below the destroyed portion is no longer supplied with horn from above, which causes a chasm or fissure in the wall.

It differs from sand crack very materially, is much wider at the base and contains a modified condition

of horn. It constitutes unsoundness, although the animal may not be lame, but he is liable to go lame at any time.

Causes.—Anything that destroys the integrity of the coronary substance, such as treads, quittors, etc.

Treatment.—If there be a wound endeavour to restore the parts to their normal condition by bringing the lips of the wound together and keeping so by bandages and treating as an ordinary wound. If the case be an old one and the gap in coronet healed up, little can be done but the application of a bar shoe. Blisters to the coronet will sometimes be beneficial.

Caution.—In examining a horse for soundness see that his feet are clean, as many tricks are played by filling cracks with guttapercha, etc., etc.

Sand Crack consists in a fissure of greater or less extent in any part of the hoof, commencing at the coronet and generally found in the inner quarters of the fore feet, called quarter crack, and toes of hind feet, rarely seen in the outer quarters. A sand crack usually proceeds by slow degrees. Prior to its appearance the horn is imperfectly secreted and is dry and brittle. Horn is built up of tubes secreted by the coronary substance and matted together, and is naturally tough. These tubes are similar to hair and are secreted by the same kind of cells. The brittle condition leading to sand cracks depends on a perverted condition of the secretory structures. Of itself horn is incapable of diseased action, being a secreted and not a formative material. A sand crack commences at the coronary band and usually extends downwards and inwards, and when it has penetrated through to the horny structures lameness is shown. Inflammation is set up both in the laminæ and in the skin above the fissure, the part is very painful and the lips of the wound gape and the tissues swell. When the animal is made to move the crack is seen to close when the foot is put to the ground, and open when it is relieved of weight. During this closure the borders of the crack grasp parts of the sensitive and swollen tissues, causing great pain and sometimes hæmorrhage. Sand and dirt insinuate

themselves into the wound, act as irritants, give rise to suppurative action, and in some instances to a high degree of irritative fever. A sand crack may occur through the bars but it is very rare.

Treatment.—If inflamed remove all sources of irritation and pare the edges of the crack if they press upon the tissues, in fact " bottom " the crack and allow the escape of pus, dirt, etc., remove the shoe and give a purgative, fomentations, poultices and rest. A fungus growth sometimes fills the crack; don't apply caustics, as the growth is the result of inflammation, depends upon it, and will disappear on its subsidence. As soon as pain and inflammation cease, put on a bar shoe, allow sole and frog pressure, relieve pressure immediately beneath crack, pare away the upper part of crack from coronary attachment and let no direct communication exist between the fissured horn and the substance from which the new horn is to be grown, or the crack will be perpetuated. A sand crack never unites, and a new horn must be grown. Blister around the coronet. There are many devices to keep the crack from spreading, as clamps, rivets, straps, etc.

Keratoma is a horn tumour caused by the pressure of the toe clip being hammered too tightly or becoming so by the animal striking his foot against the ground. These tumours and their corresponding gaps in the pedal bone are generally found in the toes of the hind feet, but sometimes in front; they are somewhat analogous to corns in the human subject and consist in increased secretion of horn caused by pressure.

Treatment.—Remove shoes and pare well out and if lameness remains cut a groove on each side.

Seedy Toe is a term applied to a perverted secretion of horn at the lower margin of the os pedis, by which the crust becomes detached from the horny laminæ. It is often a result of laminitis, or of the pressure of the clip of the shoe. It consists in the formation, by the surfaces of the sensitive laminæ, of a cheesy or mealy, imperfect horn, which is incapable of maintaining the union between the outer wall and the laminæ. Being more rapidly secreted than

healthy horn it causes a separation of the crust from the laminæ, and of the sole from the lower margin of the os pedis. It leaves a space between them which emits a hollow sound when percussion is applied to the wall. In extreme cases there is a bulging of the wall at the part affected. Lameness is not always present but is easily produced.

Treatment.—Remove all the diseased parts and promote healthy growth by the application of blisters to the coronet, and by moisture; apply a bar shoe with sole pressure and without clips.

Corns are the result of bruises involving the structures of the sensitive sole. Extravasation of blood occurs. The seat of the corn is usually the inner quarter, between the bar and the wall. They sometimes suppurate.

Treatment.—Remove the shoe, pare well out and apply poultices. When the lameness ceases shoe so as to relieve pressure upon the affected quarter.

Thrush is a discharge of a fœtid material from the cleft of the frog, usually caused by filth.

Treatment.—Cleanse thoroughly and apply calomel or sulphate of zinc to the affected parts.

Canker differs from thrush in the nature of the discharge, and in its course and tractability. It usually commences in the frog and rapidly extends, but may commence in any part of the sole.

Symptoms.—An abundant, fœtid, colourless discharge from the frog, which is large, spongy and covered with a fungoid growth. It may be confined to one foot, or two or more may be affected.

Treatment.—Remove the entire sole, dress the exposed surface with nitrate of silver, chromic acid, or sulphuric acid and tar, pack with tow and put on a leather boot. Constitutional treatment must be attended to, as this is to a great extent a constitutional disease. Purgatives and diuretics, followed by tonics and alteratives, should be given to get the animal in a good state of health.

Punctures of the feet frequently occur by a horse treading on a nail, etc., when he will go lame.

Treatment.—Extract the nail, pare out the sole to allow the escape of pus, and apply a poultice and give rest.

In examining for lameness always remove the shoe and look for trouble in the foot, press all around with pinchers, etc. The horse will show pain when the sore part is pressed. Punctures or pricks in shoeing are of two kinds, viz.: Those actually penetrating the sensitive parts, and those in which the nails are driven so close to the sensitive parts as to cause inward bulging of the inner surface of the horn and pressure upon the sensitive parts, which causes inflammation and lameness, and sometimes suppuration. In all cases where matter exists in the foot the horn must be pared away to allow its exit, else it will burrow through the sensitive parts and escape at the coronet, and before escaping will cause great pain and lameness and violent febrile symptoms, and even death from pain and exhaustion. Sometimes we find a fungoid growth appear when the sole is pared away, which, after the inflammation subsides, can be treated with caustics. We sometimes get tetanus as a result of puncture.

Quittor consists of a fistulous wound upon the quarters and heels of the coronet, generally caused by threads, pricks in shoeing, or suppurating corns.

Symptoms.—Lameness, swelling of the coronet, about the centre of which appears one or more openings discharging pus. In probing, sinuses are found leading downwards.

Treatment depends on the cause. If from an abscess in the foot, allow an exit of the matter through the sole; poultice the foot and apply blister to the coronet. If no communication exists between the wound and the plantar surface of the foot one must be made by inserting a probe or bistury into sinus and making an artificial opening on the sole; after this is done inject a solution of corrosive sublimate, 1 dr. to 2 oz. of water. This causes a sloughing of the walls and sets up a healthy action; poultice the foot. In some cases it may be necessary to remove the whole diseased structures.

Foul in the Feet is a disease of the ox and consists of inflammation and suppuration of the interdigital substances, caused by over-growth of the hoof, or irritation by dirt between the clouts, and sometimes by tuberculosis. It extends, by neglect or other causes, to the articulations and bones of the feet, producing lameness, with fever, loss of condition, etc., in extreme case, death. It is most commonly seen in the hind feet.

Treatment.—If attended to in time it is not difficult. Remove all loose horn under which the pus is burrowed, apply astringents, as alum water, sugar of lead lotion, etc.; poultice the foot and give a purgative. In some cases apply butter of antimony. If the bones and articulations are involved amputation may be necessary.

Foot Rot in Sheep is a disease which has been very much discussed on account of the doubt as to its being contagious or non-contagious. It is now generally admitted that it is contagious. It consists in an inflammation of the secretory structures of the foot, which causes a perverted secretion of horn accompanied by a discharge of fluid of a fœtid character.

Symptoms.—The sheep becomes lame in one or more feet. If the fore feet, they will be seen grazing on their knees, there is an overgrowth of horn of a soft character with the fœtid discharge.

Treatment.—Remove all diseased horn under which pus is burrowed and pare the hoofs into as natural a position as possible. Dress with a solution of blue stone or with butter of antimony.

TUMOURS.

We will briefly consider some of the tumours to which the horse is subject. They are divided into malignant and benign. The former, or that variety which, by its invasion of other tissues is likely to cause death, is rare in our patients, but it does exist, as in the disease called ostea sarcoma in horned cattle, and also in cancer of the sheath in the dog or the mammary gland in the bitch.

Treatment.—Removal by the knife when possible.

Melanotic Tumours, so called from their black discharge, are not considered malignant in our patients. They are met with in grey, white or cream coloured horses, supposed to be caused by the pigment or colouring matter of the hair, which, not being used in horses of these colours, accumulates and forms the tumours. The favourite seat appears to be around the root of the tail, and the anus, but they may appear in any part. They are sometimes found in the internal organs or brain and spinal cord. Little inconvenience is suffered unless they interfere with the functions of the limbs or vital organs.

TREATMENT.— Removal with knife if possible.

Fibrous Tumours occur in different parts of the body and are usually caused by pressure or injury. The shoulder is a favourite seat, caused by ill-fitting collars.

TREATMENT.—Remove by knife and treat as an ordinary wound.

Epithelial Tumours, or warts, are very common and may appear on any part. They consist of the thickening of the epidermis. In the dog we often find them in the mouth.

TREATMENT.—Removal by knife or torsion. If in a critical part, as the eyelid, great care must be observed in removal. It is well to cauterize after removal as they may otherwise reappear.

Cartilaginous Tumours generally appear in the region of the sternum from injury, etc.

TREATMENT.—Remove by knife.

ABSCESS.

An abscess may be defined as a tumour or swelling containing pus, or serum. If it contains pus it is called a purulent abscess ; while if the contents be serum it is known as a serous abscess. Abscesses may form on any part of the body or in the viscera, as the result of wounds or bruises, or from a poisonous condition of the blood, the poisonous material becoming localized and resulting in suppuration, or the formation of pus. The shoulders are a favourite seat of abscesses, resulting from ill-fitting collars, heavy drawing when

the animal is not in a fit condition, jerking in harness, etc., etc. Purulent abscesses generally appear slowly; the first symptoms noticed being inflammation and tenderness of the part, with some swelling; the swelling gradually increases and feels more or less hard to the touch, after a time the centre becomes soft, and the hair falls off, the skin gives way and the pus escapes. Sometimes, however, the pus is deep-seated and surrounded by hard, thick walls, through which no fluctuation of pus can be felt and the enlargement appears as a dense fibrous tumour. In many cases it is necessary to explore the tumour with a probe in order to ascertain whether it be a tumour or an abscess. Serous abscesses are always the result of contusions or bruises, they appear suddenly, are more superficial than purulent abscesses, and by manipulation the contents can be easily felt to fluctuate.

Treatment.—For either variety open at the most dependent part and allow the contents to escape, syringe out well with water and inject a little white or carbolic lotion, or a weak solution of corrosive sublimate. Dress in this manner every day and keep the external opening pervious until the internal cavity becomes healed. A fibrous tumour sometimes develops as a sequel to an abscess, in which case it must be dissected out and treated as an ordinary wound.

WOUNDS.

The term implies solution of continuity of living tissues by some mechanical cause. They are classified under the following heads, viz., incised, punctured, lacerated, contused, gunshot and poisoned.

Incised Wounds are those made by a clean cutting instrument, the textures being divided evenly and smoothly without tearing or bruising of the parts, hence the hæmorrhage is greater than in most other wounds. If the wound be parallel to the muscular fibres there will be little gaping.

Treatment.—1st. Arrest hæmorrhage. Sometimes it is necessary to ligate the blood vessels, especially arteries.

2nd. Remove all foreign bodies and cleanse the wound thoroughly by sponging with warm water (sponge carefully, or let the water run over the wound from the sponge).

3rd. Bring the lips of the wound together by sutures. Good practice to leave the wound open for a few hours to allow the escape of blood and serum. Always leave an opening at the most dependent part of the wound to allow the escape of pus. The interrupted suture is generally the best. When the incision is deep and transverse, gaping will be greater, and it is well to use quilled sutures. When the cavity is cupped make a dependent opening; in which case sew up the whole wound. Keep clean and apply a weak astringent lotion, as carbolic acid, 1 to 50, or white lotion. Should the sutures give way foment and cleanse. If the sutures hold remove them in about ten days.

Constitutional Treatment.—Purgative, low diet and quietness.

Punctured Wounds are produced by sharp or blunt pointed instruments, generally deep, with the apertures of entrance small, and the inner structures more or less torn. They are more liable to be followed by tetanus than other wounds.

Treatment.—If the wound be shallow, keep clean by syringing and using an astringent lotion and treat constitutionally the same as for incised wounds. In more serious cases the opening must be enlarged to allow the escape of serum, pus, etc. Remove all foreign bodies and partially detached tissues, stop hæmorrhage, if any; foment; poultice if practicable. Sometimes it is necessary to put in slings. If unhealthy granulations (proud flesh) appear, use caustics. Don't tie rags around wounds as they irritate the parts.

Contused Wounds are injuries inflicted by some blunt instrument without perforation of the skin, and the consequences vary according to the severity. The effect may be very short, as from a horse interfering, but if constantly repeated structural change will result.

This change varies in degree. There may be rupture of a small vessel and consequent effusion ; a large vessel may be ruptured and considerable quantities of blood be extravasated, which will coagulate. There may be the formation of a serous abscess, or a purulent abscess.

TREATMENT.—If the contusion be slight, fomentation will suffice. If much blood be imprisoned, open and remove it. When sloughing is likely to take place, hasten by poulticing, and when pus is formed open the abscess. Constitutional treatment the same as above.

Lacerated Wounds, when the skin is divided, lacerated and torn and the edges are ragged.

TREATMENT.—Make dependent opening, remove all partially detached tissue, and if practicable, stitch the wound and syringe with carbolic lotion.

Gunshot Wounds. It will not be necessary to enter minutely into this class of wounds as they seldom occur. The treatment is to remove shot or ball, if possible, and treat as punctured wounds.

Wounds of the Abdominal Walls, on account of the important structures they involve and the danger of intestinal protrusion, require special management. They are of two kinds, viz. : Shallow and deep. The shallow, involving muscles but not penetrating into the cavity, are apt to cause abscesses. The pus, forming in the wound and not gaining exit on account of the smallness of the opening, burrows between the fascia and muscles and forms abscesses.

TREATMENT.—See that the pus escapes and keep the wound open until the internal parts are healed. Dress with carbolic or white lotion.

The deeper punctures, penetrating the cavity, must be treated with a view to prevent protrusion of the intestines ; allow the escape of pus and serum, stitch, if practicable, and support by bandages. If the peritoneum is ruptured and the intestines protrude, return the intestines, suture and bandage, and treat to prevent peritonitis by administering opium, fomenting the part, being careful not to let the water into the abdominal cavity. Give injections and keep quiet.

Frost Bites. Sometimes the tissues of the coronet and heels become frost-bitten to a greater or less extent. The parts lose their vitality and become pale, insensitive and shrivelled, and will slough more or less, according to the extent of the injury.

Treatment.—Poultice and apply carbolized oil, 1 to 40 or 50.

Burns and Scalds are divided into three classes. First, those producing redness. Second, those producing vesication. Third, those producing death of the parts. The third class is the only serious one. It causes more or less constitutional disturbance and sometimes death from the shock. The surface of the part will become pale and leathery, the hair falling off and there will be a thin serous discharge. In a few days the skin sloughs off leaving a sore that is hard to heal, and it usually leaves an ugly blemish.

Treatment.—Use carron oil freely and dredge it over with flour to exclude the air.

Poisoned Wounds are usually caused by bites of venomous insects, and are not common.

Treatment.—Dressing with a dilute alkali, as baking soda, will be beneficial, as the poison is usually acid.

Results of Wounds. The unfavourable results of wounds are erysipelas and tetanus. Erysipelas may be defined as inflammation of the skin and subcutaneous areolar tissue, characterized by a diffused swelling, which has a remarkable tendency to spread, and is dependent upon some unascertained alteration in the blood. We have two forms, œdematous and phlegmonous.

Œlematous is the most common form of treumatic erysipelas, and generally succeeds wounds in the extremities in debilitated subjects.

Symptoms.—Generally about three or four days after receiving an injury the skin around the wound becomes swollen and tender, hot and painful. The swelling rapidly extends and embraces, in some cases, the whole surface of the limb. The swollen surface

pits on pressure where much areolar tissue is found, but where the subcutaneous tissues are firm and hard, the impression of the finger is not so well marked. The pulse becomes quick, rigours are present, the animal feverish, loses his appetite, and pain is manifested by lameness, if the disease be in a limb.

Phlegmonous Erysipelas is a much more violent form than œdematous and is expressed by a great amount of constitutional disturbance. The temperature runs high ; the tendons and ligaments become involved. the pain is excessive, the swellings hard and tense, and occupy a large surface. After a few days pus forms in various parts.

TREATMENT.—In the œdematous form give a purgative, foment swollen parts frequently and cover by bandages. When the purgative has operated, give diuretics and antiseptics, as 3 dr. doses hyposulphite of soda, and tonics, as the tincture of iron, and feed well.

In the other form give a purgative, combat fever by aconite, and give tincture of iron 1 to 2 fluid drs. every four hours. Foment the parts. If abscesses form they must be opened.

Tetanus consists in tonic spasms of the voluntary muscles which are long continued and uncontrollable. It is frequently a result of an injury, but sometimes occurs without obvious cause. Hence it is called trumatic and idiopathic tetanus. It is supposed to be due to a parasite. The horse is the most liable to tetanus of all the domestic animals. It is seldom seen in the ox ; is sometimes the result of a trivial injury, as a saddle gall, scratches, etc., but is more likely to follow a punctured or lacerated wound, especially when nerves are injured ; or a prick in the foot. The operations which are sometimes succeeded by tetanus are castration, docking, insertion of setons, operation for hernia, etc. A blister has been known to cause it. There are several varieties of this disease ; when the muscles of mastication are involved it is called TRISMUS or LOCKJAW ; when the superior cervical and dorsal muscles, causing the head to be elevated and the spine curved downwards it is called OPISTHOTONOS ; when the

muscles of one side are affected causing the head to be drawn sideways, it is called TETANUS LATERALIS or PLEUROSTHOTONOS. In very rare cases the inferior muscles are chiefly affected, causing the head to be drawn towards the breast and the spine arched upwards, this is called EMPROSTHOTONOS. The two first mentioned forms are mostly seen in the horse and usually in combination. Amongst the causes which may produce tetanus in addition to the irritation of wounds, are worms in the stomach and intestinal canal, collections of sand in the large intestine and uterine irritation.

SYMPTOMS.—More or less stiffness over the whole body; the animal will champ his jaws and grind his teeth; often a flow of saliva from the mouth, breathing accelerated and nostrils dilated, the nose protruded; the membrana nictitans pushed more or less over the eyes, which are withdrawn into the sockets. He is very nervous and exited. If suddenly disturbed the muscles will be seen to twitch or tremble and feel very hard, almost like a board to the touch, the tail is suddenly elevated, the eye withdrawn into the socket and the white of the eye shown, and the membrana nictitans will be noticed to shoot suddenly over the eye. The jaws are usually locked. The pulse at first is not much affected but becomes hard and accelerated. The position of the body in all cases of tetanus is regulated by the action of the most powerful muscles affected. Sometimes the animal is unable to stand.

TREATMENT.—If occurring from an operation or injury soothe the parts by fomentations or poulticing and applying the solid extract of Belladonna, and remove all foreign bodies. Treatment in tetanus is often unavailing and discouraging. The idea is to keep the animal as quiet as possible. Place in slings if necessary, let no one near him but his attendant, administer a purgative if possible, give soft food. If he cannot move his jaws at all give milk and eggs to drink, in which give 20 drops of prussic acid (Scheele's strength) 3 times a day, hypodermic injections of 1 ½ grs. of eserine is often beneficial by aiding the peristaltic action of the bowels; quietude is necessary. In cases that recover it usually takes about six weeks for the spasms to entirely disappear.

DISEASES AND INJURIES TO THE FACIAL REGION.

Wounds of the Lips must always be treated with a view to bring about perfect union of the divided parts. Be as conservative of tissue as possible.

Tumours of the Lips sometimes occur either spontaneously or from stings, and are not often serious. They will generally suppurate and burst.

Lampas is a term applied to a swelling of the gums, back of the upper incisors, in young horses. It is caused by the natural congestion of the gums during teething. It is good practice to bleed slightly in some cases, but generally it is better left alone.

Sporadic Aphtha or Thrush is a crop of small vesicles or small pustules, which occasionally appear in the mouth of horses, particularly during the process of dentition. In cattle, sheep and pigs, this condition is not uncommon, the buccal membrane peeling off, leaving the parts sore and painful, and rendering the animal unable to feed without difficulty.

Treatment.—Apply cooling and astringent lotions, as alum water, or a solution of borax. If ulcers form apply nitrate of silver solution, 5 grs. to the oz. of water.

Paralysis of the Lips occurs from injury to the 7th pair of nerves caused by wearing ill-fitting bridle or head stall, or other causes. Inflammation of the nerve is set up, followed by loss of function.

Symptoms.—The lips hang elongated and powerless, saliva flows from the mouth. When attempting to drink he shoves his nose to the bottom of the pail, and in feeding he gathers his food with his teeth only. He champs while eating and often drops his mouthful.

Treatment.—Remove the cause, feed soft food. Foment the parts and apply good sharp stimulant liniment to the muscles of the face and cheeks. If this be insufficient blister the parts. May give iodide of potash internally. Sometimes it is necessary to insert a seton. These cases are generally curable.

Open Parotid Duct. Steno's duct leads from the parotid gland to the mouth, winding around the jaw in company with the submaxillary artery ; being superficial it is liable to injury from kicks, blows, etc., and by ulceration of its coats, when involved in an abscess of strangles. From whatever cause it is opened saliva is discharged from the wound instead of flowing into the mouth. When the animal is not feeding the flow is slight, but when feeding the flow is most abundant and in ratio to the dryness of the food.

TREATMENT.—If the injury be not recent the mere closing of the wound is insufficient, because the duct between the wound and the mouth will be closed by inflammatory swelling. The first step is to open this, with, if possible, a probe. If this can't be done, an artificial opening must be made by inserting a seton and leaving in 4 or 5 days, or until suppuration is induced in the channel. It is then withdrawn and the external wound brought together by suture and collodion thickly applied. Feed soft food, as dry food causes too much salivation. If this treatment fail the gland should be destroyed by injecting into its substance the following solution. Nitrate of silver, ½ dr., nitric acid, 1 fluid dr., water, 1 fluid oz., into all the ramifications of the gland.

Salivary Calculi are sometimes found in the parotid, submaxillary and sublingual ducts. They are caused by an accidental nucleus, such as a small piece of hay or corn penetrating the canal, to which the salts of the saliva adhere, forming roundish concretions which check the flow of saliva ; the canal becomes distended with saliva.

TREATMENT.—Remove by manipulation, if possible, or make an opening with the knife and treat the same as for open duct. (Sometimes an oat gets into Steno's duct, causing it to appear as a pendulous sack on the side of the jaw. The obstruction must be removed through the mouth.)

Ptyalism or Excessive Salivation sometimes occurs when young horses are teething, or from any irritation to the mouth, or from excessive doses of mercury ; green food charged with mustard, white clover, etc., or from irregular teeth.

TREATMENT.—Remove the cause, if possible, wash the mouth with cold water, a solution of alum or borax, or with vinegar.

Glossitis, or inflammation of the tongue, when occurring as a primary disorder is due to injuries, scalds, or some chemical irritants, as administering irritating medicine, as ammonia or turpentine insufficiently diluted. The tongue is sometimes injured by the bit, or may be bitten by the animal itself or wounded by sharp or irregular teeth. If the injury be caused by irritant medicines the organ becomes very much swollen and protrudes from the mouth, its covering peeling off, the cheeks being in the same state.

TREATMENT.—If wounded, dress carefully, removing as little as possible, bring into apposition with sutures. If from irritants use cooling lotions, as vinegar and water, which serves two purposes, 1st, neutralising any remaining alkali ; 2nd, forming a grateful application to the inflamed organ. A horse with half a tongue will feel moderately well. In drinking he will shove his nose deeply into the pail.

Ulcers of the Tongue are often caused by diseased or irregular teeth, or rusty bits, or they may appear as a secondary affection depending upon indigestion.

TREATMENT.—Remove the cause, dress with nitrate of silver, borax or alum. Horned cattle are subject to induration of the tip of the tongue and it is generally incurable. It arises from no ostensible cause. As it interferes with prehension he doesn't feed well and he loses flesh. He should be slaughtered as early as possible.

Paralysis of the Tongue is generally present when the brain is extensively diseased, or suffering from the pressure of tumours, pus, etc., or it may be induced by forcible traction used when giving a ball, etc.

SYMPTOMS.—The tongue hangs out of the mouth and the animal is unable to withdraw it and saliva dribbles from it.

TREATMENT.—Force the tongue into the mouth and keep there by bandage around the lower jaw.

Abscesses form at the root of the tongue and must be opened or lacerated with the finger.

Parrot Mouth is not a disease but a deformity. The upper incisors project beyond the lower, the teeth grow long, and if the lower teeth interfere with the bars of the palate they must be dressed down.

Irregularities of the molars are of much greater importance and must be regulated by clipping and rasping.

Caries of the Teeth, or decay, is almost exclusively confined to the molar teeth, although the incisors may be affected. It may commence in the fang, crown or neck of the tooth.

Symptoms are those of pain. The horse, whilst eating, will suddenly cease masticating, perhaps drop the food from his mouth, rest his cheek on the manger, holding his head to one side, and when the pain ceases will commence to eat again, or he may quid his food, throwing out large boluses mixed with saliva. The breath of a horse with caries of the teeth is generally fœtid. Caries of the fang is usually denoted by an enlargement of the bone which contains it. Caries of the fang in the superior maxilla is usually accompanied by a fœtid, purulent discharge from the nostrils of the affected side. The fang may become absorbed without suppuration, in which case the tooth sinks below the level of its fellows.

Treatment.—Extract with forceps if possible. If not, trephine and punch out. All the molars except the last may be thus removed. After removal in this way the cavity will fill in 5 or 6 weeks.

DISEASES OCCURRING DURING DENTITION.

Occasionally the crowns of the temporary molars are not shed, remaining fixed between the permanent ones. This is common in cattle at about 2½ years old, and in the horse at 3 or 4 years old, as that is the age at which he sheds his temporary molars and gets his permanent ones. If animals at the ages stated are off their food, always examine their first three molar teeth, and if any temporary crowns be present remove with forceps.

Dentition Cough.—At three or four years old horses are subjected to what is called dentition cough. This is caused by the irritation of teething, especially the sixth molar (at 4 years) extending to the larynx. The cough is noticed more particularly in the morning when the horse begins to feed, it is loud, sonorous and prolonged. In some cases we have a tendency to diarrhœa associated with the cough.

TREATMENT.—Careful feeding on crushed oats, hay, grass and roots. Give Bicarbonate of Soda, in 2 dr. doses and if the fæces are fœtid give Hyposulphite of Soda in 3 dr. doses, and gargle the mouth.

Dentition Fever is an affection due to the same cause as the last and occurs during the active stage of dentition, when some horses suffer from a degree of constitutional disturbance, loss of appetite, debility, unthriftiness and a tendency to diarrhœa, with excited pulse, but without cough or any other symptom indicating that the fever is due to disease of any internal organ. On examining the mouth the gums are found to be red, swollen and tender, and the secretion of saliva much increased. Horses of three and four years are more subject to this trouble.

TREATMENT.—Rest and good care ; may lance the gums to relieve congestion.

Supernumerary Teeth.—What are called wolf teeth are often seen in front of the molars in the upper jaw. They have been supposed to affect the eye, but this can scarcely be the case. They can cause no inconvenience unless very large but may as well be removed.

(The dental nerve is a branch of the ophthalmic, and from this fact wolf teeth have been claimed to cause moon blindness to an animal that is predisposed.)

Nasal Gleet.—The faceo-frontal sinuses may be looked upon as one cavity, divided into frontal, maxillary and sphenoidal compartments. They communicate with the nasal sinuses by a small opening. In catarrhal affections the lining membrane of these sinuses, by the extension of the inflammation of the Schneiderian membrane, becomes diseased, and pours out a quantity

of pus, which, lodging in the various compartments of the sinuses, becomes a source of irritation, constituting what is called nasal gleet. It may arise from other causes than catarrhal affections (but this is the most common), such as external injuries, caries of the upper molars, diseases of the facial bones, collections of inspissated pus, etc., and in horned cattle and sheep from the lodgment of the larvæ of the œstrus bovis.

Symptoms.—Generally an irregular discharge from one or both nostrils. The submaxillary glands generally enlarged but loose, but sometimes hard and adherent to the bone. The breath from the nostrils is generally offensive. When the sinuses are filled with pus there will be a dull sound on percussion, and sometimes a fulness can be noticed on the face.

Treatment.—In the early stages tonics, as sulphate of copper in 1 to 2 dr. doses three times a day, and good care may effect a cure, but if pus be lodged in the sinuses (which can be ascertained by inserting a small gimlet into the cavity), we must trephine. Remove the pus, syringe out well with water and dilute carbolic acid, 1 to 50 or 60. He must have constitutional treatment, as tonics, and good food.

Choking in the horse is generally caused by the lodgment of a quantity of dry food, such as oats, cut hay or chaff, swallowed rapidly by a greedy feeder, or by a piece of potato, carrot, turnip, apple, etc. or by a large sized ball wrapped in coarse paper becoming lodged in the pharynx or œsophagus.

Symptoms.—All at once he leaves off feeding and makes all possible efforts to complete his imperfect swallow and gulp down the cause of his distress. Should he not succeed his throat and neck become, through gulping and ineffectual efforts, spasmodically drawn up, and he sometimes gives a loud shriek. If he attempts to swallow water it will return through his nostrils. These urgent symptoms are not always present, and depend upon the position of the obstruction. When in the pharynx the coughing and slavering are very violent. When in the cervical portion there is a visible enlargement along the course of the œsophagus. When in the thoracic portion of course no enlargement can be seen

and the most urgent symptoms are not present. The general symptoms are anxious expression, sunken head, tremors, sweats over the body, and exhaustion. He may want to drink and will do so until the tube becomes full from the obstruction to the pharynx which will cause violent coughing and attempts at vomition, the most of the water returning through the nostrils.

In the ox the obstruction is usually an apple or a root, as carrot or turnip. In the dog pieces of meat, bones and needles are generally the cause of choking.

Symptoms in the ox are bloating, champing of the jaws, copious flow of saliva, and attempts to swallow, and a cough, causing forcible expulsion of fæces and urine. Tympanitis is sometimes present in the horse. In the dog violent retching and coughing with staring eyes are the usual symptoms.

Treatment.—In all cases where the obstruction can be reached, remove it by the hand, or by forceps if the obstruction be sharp pointed; this form is most commonly seen in the dog. If in the cervical region manipulate, and if it can be moved at all it will generally disappear. Might give a little oil. If possible get it either up or down by hand. If this cannot be done use the probang. The horse requires a smaller one than the ox, and it is difficult to pass in the horse; he has to be thrown; œsophagotomy may have to be performed.

Dilitations and Strictures of the Œsophagus.—These two conditions are frequently associated and may be caused by scalding or the pressure of tumours. Stricture of the whole tube may be due to inflammation of its walls. In stricture there will be a great tendency to choke, with a discharge of masticated food from the mouth.

Treatment.—Pass probangs of various sizes in order to dilate the tube, and feed carefully.

Crib Biters and Wind Suckers.—These are vices but predispose to diseases. A crib biter seizes the manger or some other object with his teeth, arches his neck and makes a belching noise, after a time the abdomen becomes visibly enlarged. Some thrive moderately

well, while others are always unthrifty, dry in the coat, and hide-bound. A chronic cribber may be easily recognised by the way his incisors are worn and rounded at the anterior borders.

A wind sucker smacks his lips, gathers air into his mouth, extends his head, or presses it against some solid body, arches his neck, gathers his feet together and undoubtedly swallows air, blowing himself out sometimes to a tremendous extent. Of the two vices this is the worst, a wind sucker being more subject to colic and indigestion, etc.

To prevent crib biting buckle a strap rather tightly around the neck, and for wind sucking a strap studded with sharp points of iron opposite the lower part of the jaw is the best preventive. Want of work, indigestion, and the irritation of teething are generally the causes of these vices.

DISEASES OF THE EYE.

Simple Ophthalmia or Conjunctivitis is caused by a blow, bites of insects, common cold, or the lodgment of a foreign body in the eye. Inflammation of the superficial structures is manifested by closure of the eyelids, swelling of them, and increased secretion of tears, which flow down the cheek, scalding the skin to such an extent that it soon becomes divested of hair at every part over which the tears flow. The eye is retracted and partly covered by the membrana nictitans. If the eyelid be turned up the conjunctiva will be found to be congested and covered by red streaks. The surface of the cornea is dim and blue looking, with gradually increasing opacity.

Treatment.—If a foreign body be in the eye remove it, foment and exclude the light. May bleed from the angular vein, or scarify the inner surface of the lids. Apply Belladonna in the form of paste to the eyebrows and outside of the eyelids, or atrophia sulphate, 2 grs., distilled water, 1 fluid oz. Give a purgative, followed by diuretics. The opacity of the eye is due to an exudate thrown out between the layers of the cornea, not to a film or scum upon the external surface of the eye, as it appears to be. If the inflammation is due to an injury the opacity will gradually

extend from the seat of the injury to the circumference. If due to other causes it will extend from the circumference to the centre.

Nebula-Albugo.—A partial opacity sometimes remains after the removal of the general dimness, or film, as it is sometimes called. The opacity of the cornea, caused by an injury, often remains as a permanent blemish. An opacity of this kind is at first of a bluish tinge and is called a nebula, as it becomes older it turns to a pearly white colour, and is called an albugo. Occasional touches of the solid nitrate of silver, or a solution of it applied with a camel's hair pencil, will hasten the absorption of the surrounding lymph. "The practice of blowing irritating matter, as burnt alum, pounded glass, etc., through a quill, cannot be too highly condemned, as it is calculated to irritate the whole surface of the conjunctiva, entail suffering and do harm." These opacities are only, when sufficiently large, or when so situated as to interfere with vision, to be regarded as unsoundness.

Staphyloma is a disease of the eye, so named from its being thought to resemble a grape. In this disease the cornea loses its transparency, rises above the level of the eye, and even projects beyond the eyelids in the form of a whitish coloured tumour, which is sometimes smooth and sometimes rough on its surface. It is not a rare disease amongst dogs. It is occasionally seen in horned cattle, but seldom in the horse, except in the spurious form which consists in incision of the cornea propria, allowing a bulging outwards of the cornea elastica. In the dog it occurs from two causes; 1st, a growth on the cornea; 2nd, dropsy of the aqueous chambers. The first may be caused by an ulcer, the progress of which should be stopped by touching with a pencil of nitrate of silver, and afterwards remove the thickening with the knife. The second form is best treated by puncturing and allowing escape of the contained fluid.

Glaucoma is a disease in which the vitreous humour loses its transparency and assumes a blue colour. It is very uncommon, and is usually associated with cataract or amaurosis.

Amaurosis is a disease of the optic nerve and its expansion, the retina, whereby they lose the power of receiving and transmitting the impression of objects to the great nerve centre, the brain.

SYMPTOMS.—The pupil is dilated, round and motionless, the eye glassy in aspect, the eyelids open more than usual. The animal may be said to stare. The gait, and motion of the ears are indicative of blindness. It is possible to have it in but one eye, but this is very rare in the lower animals, and is generally indicative of brain trouble. Excessive hæmorrhage has produced sudden and permanent blindness in both horses and cattle. Excessive discharge of secretions, as in polyuria, or excessive perspiration, due to excitement or viciousness, may cause it. To detect, place the animal in strong light, cover the eye with the hand; when the hand is removed, if the eye be sound, the pupil will contract, if diseased, it will not.

Strabismus—Squinting—is irregular actions of the muscles of the eye. It never occurs in the lower animals except as a sign of another disease, as indigestion, tetanus, and blood poisoning, etc.

Ectropium, or eversion of the eyelids. The eyelid is drawn away from the eyeball, its conjunctival surface turned out. The ball, being thus deprived of the protection of the lid, is exposed to constant irritation, by which a chronic conjunctivitis is set up, weakening the eye and giving rise to specks and vascularity of the cornea.

TREATMENT.—If not very extensive, it may be reduced by the nitrate of silver. If this be not sufficient excise an elliptical piece of conjunctiva.

Entropium, or inversion of the eyelids, is the converse of ectropium. The free edges of the eyelids and the eyelashes are turned in against the eyeball, which they keep in a constant state of irritation by the friction they exert upon it. Very often entropium is congenital, but may occur from relaxation of the integument of the eyelids, and a spasmodic contraction of the muscles which separate the lids.

Treatment.—Excise an elliptical piece of the skin and stitch up the wound.

Warts on Eyelids are not uncommon. If they have a constricted neck, excise or ligature. If broad at the base use strong acetic acid or butter of antimony.

Wounds of the Eyelids are to be treated on conservative principles.

Warts on the Membrana Nictitans are to be removed by the knife first transfixing the membrane by means of a suture or the tenaculum.

Falaria Oculi are small thread-like worms, sometimes found in the aqueous humours of the eye, especially in horses pastured on low damp ground.

Symptoms.—Conjunctivitis, the cornea obscured by nebulous effusion, the eyelids closed, and intolerance to light. On close inspection a small, white, thread-like worm can be seen floating in the aqueous humour.

Treatment.—Puncture the cornea at its upper and outer margin and allow the parasite to escape with the aqueous humour.

Fungus Hæmatodes consists of a dark coloured vascular tumour growing within the orbit, appearing at first as a red spot at the posterior part of the eye, becoming larger, it involves the eye and the surrounding orbital bones. The tumour is malignant in its nature and so infiltrated with blood that it looks like a blood clot, is of rapid growth, and if not entirely removed at an early stage, admits of no cure. It is oftenest seen in the ox but is sometimes met with in the horse.

Treatment.—Remove everything in the orbit and cauterise the parts.

Periodic or Specific Ophthalmia or moon blindness is a constitutional affection arising from some cause acting primarily on the constitution and secondarily on the organ of vision, terminating in an opacity of the crystalline lens, called cataract.

Symptoms.—The attack is generally sudden and without apparent cause and the eye presents the general symptoms of inflammation. The dullness which

is present spreads from the margin to the centre. The pupil becomes contracted more and more and the conjunctiva intensely reddened. The inflammation is apt to move from one eye to the other, and for this reason, and on account of its recurrent nature, it has been called gouty ophthalmia.

Treatment.—A cure cannot be effected but aid may be given by treating as for simple ophthalmia. The inflammation may subside and the eye regain quite, or almost, its normal condition and remain without active disease for a variable time, or in a few days the inflammation may again appear. There may be weeks or even months between the attacks. After several attacks we usually have cataract form and consequent blindness. In rare cases one attack destroys the eye and forms cataract.

It is somewhat difficult to distinguish between simple and periodic ophthalmia. The inflammation in periodic is not generally so acute, but will not as readily yield to treatment. The pupil does not regain its original form but looks smaller than its fellow, and the eye seems smaller than natural, and the eyebrow and upper lid usually have a wrinkled appearance; a dimness of the cornea remains.

Cataract consists of an opacity of a part or the whole of the crystalline lens or of its capsule. It is divided into true and false; false consists in opaque deposits of lymph, blood or pus on the anterior capsule, obstructing the pupil. The distinction of the various kinds of cataract as capsular, lenticular, capsulo-lenticular, true and false, is not of such great importance to the Veterinarian, as total blindness is preferable to partial in the horse.

Cataract is usually the result of periodic ophthalmia, but may proceed from other causes, as an injury, or appear without any assignable cause.

Dislocation of the Eyeball is sometimes met with, especially in dogs, from fighting, etc. It sometimes hangs pendulous on the cheeks. In such cases carefully return the eye, and, strange to say, it generally regains its usefulness.

Removal of the Eyeball is seldom necessary except in malignant disease or in the enlargement of the whole organ preventing closure of the eyelids. If the cornea be removed the humours, lens, etc., escape, the eye will collapse and the various coats become adherent.

DISEASES OF THE HEAD, NECK, VEINS, Etc.

As the ears of the horse are almost exempt from disease, except from injury, we will pass them over. Dogs occasionally suffer from ear trouble.

Poll Evil is a fistulous ulcer, situated behind the ear, caused by injury, or the habitual use of the tight bearing rein. It may at first be a soft tumour, surrounded by swelling, with stiffness of the neck, or it may merely be a serous abscess.

Treatment.—Before pus forms, allay the inflammation by fomentations and give a purgative, and reduce the swelling by a blister or iodine ointment; do not puncture. If suppuration be established, open as soon as possible at the most dependent part and treat as an abscess. If the abscess has already burst and is discharging a fœtid pus, we know we have a serious case. The sinuses must be all thoroughly explored and opened to their very bottom, and the bone scraped if diseased, and dressed with a solution of corrosive sublimate, about 5 grs. to the oz. of water. A thin layer of the parts laid open will thus be destroyed and the whole made into a common wound, to be treated as such. When caused by the tight bearing rein, it is deep-seated, often involving a joint, causing anchylosis and consequent stiff neck. Sometimes in operating we have to cut the ligamentum nuchea clean across. It will unite along with the other tissues.

Fistulous Withers resembles poll evil in all particulars except its seat and the parts involved. Is caused by bruises, ill-fitting saddles, etc. The treatment is the same as for poll evil. In some cases the sinuses run down between the scapula and ribs, in which case a cure is very hard to effect. The spines of the dorsal

vertebræ are often diseased. In treating, as in poll evil, when necessary to cut, don't spare the knife, but get to the bottom of each sinus.

Inflammation of the jugular vein sometimes occurs as a sequel to bleeding, especially when there is a constitutional predisposition to local inflammation. The exciting causes are using a rusty fleam, bungling in the operation, or the animal may disturb the wound by rubbing, etc.

Symptoms.—The lips of the wound separate and discharge a bloody fluid, the surrounding parts become inflamed, and the vein, in its course to the head, feels like a hard cord of considerable thickness. Sometimes abscesses form in different parts along its course, which can be detected by fluctuations, etc. In some cases the vein may regain its normal condition, but generally it becomes converted into an impervious cord.

Treatment.—If abscesses form, open them, foment continuously and follow by blisters. Give a purgative and diuretics. The animal must not be turned to pasture, as the collateral circulation is not sufficient to carry the blood from the head whilst it is kept in a depending position during grazing.

Varicose Veins are not often seen in our patients, and are those in which a dilatation exists, due to an obstruction, or a relaxation of the coats of the vein. It occurs in the jugular as a result of bleeding, and in the vena-saphena by pressure from bone spavin. The veins of the extremities of horned cattle present varicose dilations along their course, in the form of sacculated knotty protuberances, on various parts of the vessels. The contained blood is at first in a fluid state, but an alteration frequently occurs, the blood coagulates, and the vessels become obstructed. The formation of these coagula is an effect of inflammation in the coats of the vein, which may cause abscesses.

Treatment.—If no inflammation exists, give good food and tonics, and pressure to the parts by bandages. If abscesses form, open and blister, but don't use pressure. If a large varix, without inflammation or clot, exists, the vein may be obliterated by inserting

two needles, one above and one below the dilatation, with a thread tied around them, the needles being allowed to ulcerate their way through, care being taken not to insert the needles through the vein, but below and above it, to entirely shut off the circulation.

Phlebolites, or vein-stones.—Concretions have been found in the dilated veins in the neck and other parts. They are formed by calcareous degeneration of the coagula, and are composed of the phosphates of lime and magnesia.

Air rapidly injected into a vein causes sudden death, but if injected slowly it only causes great distress. Death occurs as follows: The blood mingles with the air and becomes frothy in the right ventricle, is sent through the pulmonary artery, becomes arrested in the pulmonic capillaries on account of the obstacle presented by the air bubbles. The quantity of blood transmitted through the lungs for the systemic circulation grows less and less according to the increase of its arrest in the capillaries. The supply to the head is inadequate to afford due stimulus to the nervous centres, and syncope results. If circulation be not restored, this continues, the respiratory movements cease, and life becomes extinct, the heart last failing in its action for want of its necessary stimulus the blood.

DISEASES OF THE ARTERIES AND LYMPHATICS.

Embolism Arteritis or inflammation of an artery is rarely seen in the horse, but sometimes occurs. The iliac arteries and their branches are embedded in very powerful muscles, and during violent contractions of these muscles are liable to injury, causing inflammation; exudation from the walls of the vessels forming the nucleus of a clot which partially or entirely closes the vessel; this is called an embolism.

The SYMPTOMS of an embolism in the external iliac are coldness of the extremities with muscular debility, which increases on exercise; if both arteries be plugged the symptoms resemble those of paraplegia. There is an absence of pulsation in the artery, detectable by

examination per rectum. During repose very little, if anything, wrong can be detected, but when the horse is compelled to move he soon shows great pain and inability. Clots may form in the heart and be forced into the arteries, or may form in the veins and be sent to the heart, causing sudden death.

TREATMENT.—Very little can be done.

An Aneurism is a pulsating tumour containing blood and communicating with the interior of an artery. They are divided into true and false. The true is due to disease of the arterial coats, causing the dilatation of them. The false is a wounded artery when the blood, prevented from escaping externally, becomes coagulated in the areolar tissues and forms a sort of a cyst; the wound in the artery remains open, and the pulsation can be felt over the enlargement. Aneurisms of the anterior mesenteric and the posterior aorta are quite common. Dr. Bruckmuller examined sixty-five horses and found only six free from aneurism of the anterior mesenteric artery. In the investigation of obscure diseases it will be well to remember the frequency of aneurism.

TREATMENT.—In aneurism of a deep-seated artery, very little can be done. Iodide of potassium may stimulate absorption. In external aneurism use pressure or ligature on the cardiac side and the aneurism will become absorbed. Aneurism of a large artery may cause sudden death by rupture of the arterial coats, the symptoms being those of any excessive hæmorrhage, viz., rapid sinking of the vital powers, pallor of the mucous membranes, coldness of the body and extremities; the animal, before dying, usually uttering a shriek of agony.

Degenerative Diseases of the Arterial Coats are met with in three forms in the horse, viz., calcareous degeneration, the most common; second, cartilaginous deposits, chiefly found in the small arteries removed some distance from the heart; third, fatty degeneration found in old and pampered animals. Rupture of an artery may occur from degeneration of its coats, and is sometimes the cause of apoplexy when occurring in the cerebral artery.

Lymphangitis, or inflammation of the lymphatics, is known by various names, as a shot of grease, weed, shake, or Monday morning disease. It is usually confined to one hind leg, but sometimes both, and rarely one or both fore legs are affected.

SYMPTOMS.—It generally occurs after a day or two's rest, and is ushered in by rigours and uneasiness, and lameness soon shows itself in the affected limb. A hot stage succeeds the rigours, the animal blows, sweats bedew the body, the pulse is hard, full and strong, the visible mucous membranes injected, the bowels constipated, urine scanty and high coloured. The local signs are swelling of the inguinal glands if in the hind limb, and the brachial if in the fore. The swollen glands are very painful when pressed upon, and a swelling extends downwards from them, first as a narrow elevation on the inner side of the thigh or arm, but soon extending in every direction it involves the whole circumference of the limb, from the body to the foot. As the swelling increases, the pain and lameness usually subside. Lymphangitis is liable to recur periodically until the limb assumes a chronically enlarged condition, called ELEPHANTIASIS, from the exudate becoming organised. Pus is sometimes formed. This may be suspected when the attack is more stubborn to treat then usual, and when the swelling extends along the belly, involving the sheath or mammary gland. When pus forms, the abscess must be opened at once. The causes of lymphangitis are irritation to the lymphatic glands by chyle rich in nutritive material, and in some rare cases to blood in a highly fibrinous condition, owing to metamorphosis of tissue. The first is produced by overfeeding and want of work ; the latter when the animal has not been feeding well for some time, the blood being in a fibrinous condition.

TREATMENT.—Give a purgative followed by diuretics, fomentations long continued and often ; apply a stimulant liniment, exclude draughts. When the inflammation and lameness subside, exercise. Do not exercise during the inflammatory stage. Elephantiasis is incurable.

HERNIA OR RUPTURE.

A Hernia is a tumour formed by the displacement of a viscus, or any portion of a viscus, which has escaped from its natural cavity by some aperture, and projects externally.

Abdominal herniæ are divided into reducible, irreducible and strangulated, according to their condition; and into inguinal, scrotal, ventral, umbilical and diaphragmatic, according to their situation.

A hernia is reducible when it can be easily returned into the abdomen. It consists of a soft fluctuating swelling unattended by heat, pain or uneasiness. When the animal coughs it becomes tense, large, and communicates a sudden impulse to the hand of the examiner. It may be formed of intestine only, in which case the swelling is elastic and compressible, and its return to the sac is sudden, and accompained by a gurgling sound. If the swelling be more solid and feels doughy to the touch, receives an impression from the fingers, and returns more slowly to the sac unattended by a sound, it is formed of omentum only. Sometimes we have both the intestine and omentum, when the symptoms will be a combination of the above.

A hernia is irreducible when it is not strangulated and yet cannot be returned into the abdomen. The causes which prevent reduction are, 1st, the bulk of the protruded parts is out of proportion to the opening through which they have to return; 2nd, adhesion of the parts to the sac.

A strangulated hernia is irreducible, and the compression of the blood-vessels impedes and disturbs the circulation, causing inflammation of the parts.

Umbilical Hernia is a protrusion of a portion of intestine through the navel opening, forming a tumour at that part. It is often congenital. If not congenital it usually takes place shortly after birth and arises from a yielding of the umbilical opening, the closure of which is lax and weak. In some cases this weakness remains until the animal is three or four years old,

and rupture may occur at any time from any violent effort. In foals, umbilical hernia is often spontaneously reduced.

Treatment.—Apply clams, skewers, ligature, truss, or open and return the viscus, and suture. In some cases the application of nitric acid will effect a cure. In applying clams, etc., place the animal on his back, carefully return the viscus and enclose the loose skin tightly in the clam, or whatever you use; be careful to not enclose any intestine or omentum. Allow the clams to slough off.

Ventral Hernia is that form in which the protrusion occurs through an artificial opening caused by laceration of the muscular and tendonous fibres of the abdominal walls, and may be situated at any part. The tumours vary greatly in size. Large ventral hernia is seldom curable, but should the opening be not very large and treatment prompt, the same treatment as for umbilical hernia is adopted. I have found good results from both truss and clams.

Inguinal Hernia is that in which a portion of intestine has passed through the internal inguinal ring and may be lodged in the canal, or have passed through the outer ring to the scrotum. In the former it is invisible. It generally appears suddenly and often becomes strangulated. Not common in this country on account of horses being castrated early and allowing the inguinal canal to contract. It is sometimes seen in geldings and even in mares.

Symptoms. If strangulated, colicy pains, which are relieved by the animal lying on his back. In this case examine per rectum, explore the internal ring with one hand and manipulate the scrotum with the other. The strangulated intestine can be felt if hernia exist. If the hernia be not reduced the symptoms increase in severity, the pains become continuous. Cold sweats bedew the body, the pulse becomes thready, the eyes injected and the pupils dilated. If strangulation does not exist it is hard to diagnose, unless the hernia is of considerable size. It sometimes is very large, the swelling yields to pressure and regains its former size when pressure is removed.

Congenital Scrotal hernia is the most common form and the least dangerous. It is often seen at birth or shortly after, and will usually spontaneously disappear gradually after the colt is six months old, from the normal contraction of the omentum.

TREATMENT.—If in a colt give nature a good chance to effect a cure, but if the hernia continue or if it occurs in a horse or gelding and it is decided to operate, the animal must be starved for a few hours, then thrown and placed on his back, when, if the hernia is not strangulated, it can be returned. If in a gelding the scrotum must be gathered and a clam put on to prevent the intestine from coming down, and the clam let slough off, by which time an exudate will generally have been thrown out which closes the opening. If a stallion, the intestine must be carefully returned and a clam put on, enclosing the skin, scrotum and cord (the testicle may or may not be removed), and the clam allowed to slough off. If the hernia is strangulated it may be necessary to enlarge the inguinal rings to allow its return, and of course treatment must be prompt or death will occur from inflammation of the bowels. Great care must be taken to not injure the bowel with the knife; when the hernia is reduced apply clam as above. Scrotal hernia is common in young pigs and they should be castrated by the covered operation. It is sometimes done by returning the intestine and tying a cord around the scrotum and cord and allowing it to slough off. The covered operation consists in cutting through the scrotum only and enclosing the peritoneal coverings of the testicle along with the cord, and allowing the clam to slough off.

DISEASES of BLADDER and EXTERNAL ORGANS of URINATION.

Calculi are found in the bladder as well as in the other organs of urination. These vary in chemical composition with the genius of the animal, and with the nature of food and water. The carbonates of lime and magnesia make up the bulk of urinary calculi in horses and ruminants. The first requisite is that some body should exist as a nucleus. This may be mucous

fibrin, or blood, or some foreign body introduced from without. They are sometimes smooth and sometimes rough and gagged.

Cystic Calculi—Stone in the bladder.

SYMPTOMS.—Some stiffness in the hind limbs, a frequent desire to urinate with but little or no result. Urine may pass freely for a time and then suddenly stop, or may pass in driblets or jets; sometimes blood clots are noticed, and microscopic crystals can be detected. Examine per rectum, when the stone can generally be felt.

TREATMENT.—In the mare it can often be removed, without cutting, with the spoonbill forceps. In the stallion or gelding, the operation of lithotomy is necessary. Pass a catheter, cut down upon it through the perineum, withdraw the catheter and pass the forceps into the bladder and remove the stones. Generally necessary to cast and chloroform to operate.

In the ox the catheter cannot be passed and we have to cut down on the urethra without its aid. Generally the calculi are in the urethra in these animals and we can detect them and cut down on and remove them.

Urethral Calculi occur in sheep as well as in oxen, and give rise to symptoms of great distress. The animals repeatedly attempt to urinate, pant, grunt, are restless, alternately lie down and rise, and if not relieved die with symptoms of abdominal pain and irritative fever. They should be removed as in the ox.

Preputial Calculi sometimes attain a sufficient size to cause difficulty in urination. They are commonly composed of dirt, mixed with secretions of the follicles of the prepuce and sheath. In order to prevent this inconvenience the sheath should be examined and washed occasionally. In the ox and sheep deposits of phosphates form around the preputial opening, causing an obstruction to the emission of urine, and much inconvenience. They, and the hair or wool to which they are attached, are to be cut off, and if the concretions have accumulated in the sheath they must be carefully removed with the fingers or forceps.

Collection of Sandy Matter in the Bladder, sometimes seen in the horse, the crystals remaining apart instead of becoming agglutinated together. This condition can be detected by the horse passing a whitish matter after urinating.

Treatment.—Inject warm water into the bladder, and stir up its contents with the hand inserted into the rectum. In some cases the accumulation is so great that an operation resembling lithotomy, must be performed, the collection being removed with the spoonbill forceps. Animals subject to this should be allowed small doses of hydrochloric acid in their water every now and then.

DISEASES of the EXTERNAL ORGANS OF GENERATION.

Urethritis may arise from a general catarrhal condition of the mucous membrane, or from the administration of irritant medicine, as cantharides or croton oil, or from too frequent copulation, connection with a diseased or lately delivered mare, injury in serving, etc.

Symptoms.—Frequent desire to urinate, the act being performed with difficulty, frequent erections and a discharge from the urethra, followed by more or less swelling of the genitals. Ulcers sometimes form upon the prepuce.

Treatment.—Bathe with warm water, apply mild astringents and inject into the urethra sulphate of zinc, 5 grs. to water 1 fluid oz. If ulcers form touch with a pencil of the nitrate of silver. Give a laxative and bicarbonate of soda, 3 dr. doses 3 times a day, followed by tonics, as sulphate of iron 1 dr., gentian 1 dr., 3 times daily.

Phymosis and Paraphymosis. In the first case the penis is imprisoned and cannot be drawn. In the latter it is protruded and swollen and cannot be retracted. The former may be caused by a swelling of the sheath, or enlargement of the penis from any cause. The latter may depend upon the same causes, and in old animals it sometimes depends upon a paralysis of the muscles which withdraw the penis.

TREATMENT.—If inflammation be present foment the parts and purge. If the sheath be much swollen, scarify, also scarify the penis if it be much swollen. In paraphymosis it is sometimes necessary to amputate the penis. Cast the animal, cut the protruding portion of the penis off, insert a silver tube into the urethra and leave in until the parts are healed. Treat as an ordinary wound.

Vaginitis sometimes occurs after parturition.

SYMPTOMS.—The mucous membrane of the vagina is highly injected, the lips of the vulva generally swollen, followed by a discharge of a sanious material from the vulva, which excoriates the parts with which it comes in contact, causing considerable straining. It may prove fatal by extending to the uterus.

TREATMENT.—Give opium to prevent straining and arrest inflammation. Inject the vagina with tepid water to which is added carbolic acid. Give enemas per rectum and give hyposulphite of soda in the food. Should the discharge become chronic the disease is called LEUCORRHŒA or the whites, and must be treated with local astringents and antiseptics as carbolic lotion, or a solution of corrosive sublimate; and tonics must be given internally.

Garget or Mammitis.—Inflammation of the mammary gland is caused by injury, exposure, irregular milking, or derangement of the health. It is frequently seen shortly after calving.

SYMPTOMS.—The udder is warm, tense and glistening, and more or less swollen, sometimes there is lameness. There is pain, with suspended secretion of milk, the milk is often curdled or bloody. There is fever and general systemic disturbance. It may end in abscess, induration, or gangrene; one or more quarters may be affected. A perfect recovery may occur.

TREATMENT.—Give a purgative, followed by diuretics, poultice, or bathe the udder with warm water. Rub well with camphorated liniment. Draw the milk off often, feed on light diet. If rigours occur give stimulants and clothe warmly. If the teats are very sore, draw off the milk with a teat syphon; if abscesses form

open them ; if induration occurs rub well with tincture of iodine ; if gangrene results the affected parts must be removed. In a very painful case of mammitis a solution of the solid extract of belladonna, about half an oz. to a pint of water, makes a good application to allay the inflammation and local irritation.

Impervious Teat is caused by concretions from the milk, from fibrous growth, which is often congenital, thickening of the mucous membrane, from closing of the external orifice effected in the healing of a sore, etc.

TREATMENT.—Concretions may be removed by manipulation or a grooved director ; when due to a fibrous growth the concealed bistony must be used. A syphon may be kept tied in the teat to keep the channel open.

Sore Teats, Scabs and Warts.—The two former must be treated by bathing and applying carbolized oil or oxide of zinc ointment, and using syphon in milking. Warts must be removed by knife, shears or caustics.

DISEASES OF THE SKIN.

Skin diseases may be caused in different ways (some are contagious), viz : indigestion, a morbid condition of the blood, local irritation, the presence of parasites, or the derangement of any of the internal organs may cause irritation of the skin, the result of which is manifested in various ways, some of which we will now consider.

Erythema. Inflammation of the outer layer of the dermis. Its character is that of uniform redness, with heat, swelling and irritation.

CAUSES.—Cold and heat operating alternately on the skin, wet, friction, dirt, pressure, and constitutional causes, as hereditary predisposition, debilitating diseases, plethora and poverty. When the heels are affected it is called SCRATCHES or CRACKED HEELS ; when the greater part of the hind limbs, from the foot to the body, MUD FEVER ; when the front of the hock, SALLANDERS ; when back of the knee, MALLANDERS.

Symptoms.—Pain, heat, tenderness and redness, followed by sores or cracks, with more or less swelling. It may become unhealthy or foul smelling, and a greasy fluid will be discharged. There will be more or less swelling of the limbs affected.

Treatment.—Give a purgative, followed by diuretics and alteratives. Dress the parts with white lotion, carbolised oil, or zinc ointment. The lotion is better in warm weather, oil or ointment in cold weather. If unhealthy and foul smelling, poultice with boiled turnips or linseed meal, to which may be added some powdered charcoal. It is sometimes necessary to apply a caustic, as butter of antimony, once or twice, if the parts are slow to heal. Do not wash.

Surfeit or Nettle Rash consists of an eruption of elastic vesicles, attended with itching. The lumps rise very quickly and upon the greater part of the body, sometimes disappear as quickly as they come. It is caused by some derangement of the digestive apparatus. A sudden change of diet, over-heating, or drinking largely of cold water when hot may cause it.

Treatment.—A purgative is generally all that is needed. Should there be great itchiness bathe with warm water and apply white lotion.

Eczema.—Most skin diseases of horses may be said to be some form of eczema.

Eczema Simplex is a non-contagious disease. It usually comes on suddenly and is manifested by itchiness, the hair and cuticle become rubbed off, leaving the skin red, raw and inflamed. Successive crops of vesicles develop themselves, dry on the sore skin, or discharge a fluid which seems to cause an extension of the disorder. It is generally called mange, but it differs from true mange in being non-contagious and in not being due to a parasite. The head, neck and shoulders are the favourite seat, but it may attack any part.

Treatment.—Give a purgative, followed by diuretics and alteratives. Wash the parts thoroughly with strong soap-suds and apply carbolic or white lotion.

Eczema Pustulosum, or Grease, is an inflammation of the skin at the back of the heels and the fetlocks, extending upwards. Vesicles and pustules form, yielding a fœtid discharge, accompanied by considerable swelling; the skin at the heels becomes rigid. The skin cracks, becomes a mass of soreness, ulceration and fungus. The hind limbs are chiefly affected and the disease is apt to become chronic. The fungoid growths become more pronounced and are called grapes.

TREATMENT.—Purge, give alteratives, poultice. Apply zinc ointment, carbolic acid or white lotion. If grapes abound, use the knife or actual cautery, followed by caustics.

Sitfasts are caused by the pressure of the harness, collar, saddle, etc., and consist of patches of skin, all of which has lost its vitality except a small portion in the centre which adheres firmly to the subcutaneous tissue and is surrounded by a suppurating wound.

Parasitic Diseases of the Skin may be considered under two heads: First, those due to animal parasites; second, those due to vegetable parasites. Of the first variety is SCABIES, MANGE, SCAB OR ITCH, a contagious disease due to the presence of animal parasites which are different varieties of acari. It attacks all the domestic animals but is seldom seen in this country.

SYMPTOMS.—Intense itching, aggravated by hot weather or buildings, and by perspiration. In sheep the wool drops off. The skin is thickened and rendered rigid by exudation into its substance, as well as by the accumulation of crusts on its surface; but the reliable sign is the presence of the parasite, which can sometimes be detected by the naked eye when a little of the scurf is placed on a piece of glass and closely watched, a low magnifying power is a great help.

TREATMENT.—First soften the scab well with oil, then wash with soap-suds and apply the following ointment: Two parts sulphur, one each of the oil of tar and potassium carbonate and ten parts of lard. Give good food, tonics and alterations. Isolate the animals, wash clothing, harness, etc., and whitewash the stalls, etc.

Lice are parasites destitute of wings, which infest the skin of the lower animals.

Treatment.—Clip the animal, if practicable, and apply a decoction of stavesacre seeds, 1 oz. to a pint of water.

Poultry Lousiness causes animals great distress, the insects can usually be seen with the naked eye.

Treatment.—Same as above, of course removing the cause.

Warbles are found in little rounded tumours on the backs of cattle in winter and spring, each tumour having a hole in the centre, through which the grub may be seen or extracted. The gad-fly deposits its eggs on the skin and they become developed into the larvæ of the fly. The act of depositing the egg seems to cause pain, as it causes the animal to become furious and gad and stray from the pasture, hence the name. The grub can be pressed out with the fingers.

Maggots may quickly appear in any sore in warm weather, unless great care be taken. They are hatched from the ova of the large blow-fly. Maggots are frequently met with on sheep, the ova is deposited in the wool, especially about the rump or root of the tail, if any ways dirty ; they burrow beneath the skin and cause suppuration.

Treatment.—Cleanse the sores and dress with carbolic lotion, or the following : Three parts oil of tar and one part oil of turpentine.

Common Ringworm is common in horses, cattle, dogs and cats, as well as in man ; is readily transmitted from one to the other. It occurs as round, bald spots on the face or elsewhere, covered with white scales and surrounded by a ring of bristly, broken hairs, with scabs around the roots. Soon this ring is shed and a wider ring is formed. If examined by a microscope, a vegetable parasite may be found on the hairs or hair follicles.

Treatment.—Pull out the hairs with a forceps and paint the parts with tincture of iodine, or apply hellebore ointment, strong carbolic lotion, etc.

Honey-Comb Ringworm is common in cattle, dogs and cats, as well as in children. It shows the same general appearance of baldness, advancing from the centre, as the above, but a cup-shaped yellowish scab results, which has obtained for it the name. It is caused by another form of vegetable parasite. Treat the same as for common ringworm. Cleanse all clothing, harness, etc., that has come in contact with the animal.

Castration.—The operation by which the horse is unsexed is generally performed upon him when he is about one year old, and at a season of the year when the weather is moderate. The month of May or the first half of June is the favourite period. Some colts are not castrated until they are two or three years old, while others are operated upon at a few weeks old. I consider the latter the better time to operate. Other animals, as lambs, calves and young pigs, are generally castrated when quite young.

Precautions to be observed before Operating.

1st. Examine the scrotum carefully in order to ascertain if hernia be present, and whether the testicles have descended, for in some instances, either from narrowness of the inguinal canal or some other cause, the testicles, or one of them, may be retained in the abdominal cavity. If the testicle be retained in the neighbourhood of the kidney, above the peritoneum, the animal is said to be a true ridgling. If the testicle has descended to the bottom of the abdominal cavity but has not passed through the inguinal canal, or may have passed through the internal ring and be confined in the canal, the animal is said to be a false ridgling, or a flanker.

2nd. Do not operate upon a thin, weakly animal, nor upon one suffering from any disease, especially from strangles, influenza, or any respiratory trouble.

3rd. Do not operate during very cold weather, when an easterly wind is blowing, nor in sultry weather when flies prevail.

4th. Do not operate upon an animal of any age which is confined to an ill-ventilated, ill-drained or otherwise unhealthy shed or stable, nor upon one stabled with a great number of horses.

5th. Be very careful that all instruments required for the operation, and also the hands of the operator, be scrupulously clean, and the knives sharp.

6th. If the operator has conducted a post-mortem examination of any animal, or has attended a case of parturition, or has performed any operation calculated to produce a taint that may cling to his clothes, hands or instruments, he must thoroughly disinfect his clothes, etc., and postpone the operation of castration for at least one day.

If the animal be in good condition, it is good practice to restrict the supply of bulky food, and stint him in the supply of water for a few hours before operating. If he be not in good condition, the operation should be postponed for a few weeks, and the animal well fed in the meantime. If he be in too gross a condition, it is well to purge him once or twice and reduce his food in order to prepare him for the operation.

Having decided to operate, the animal is cast and firmly secured and held on his back, unless the operation is to be performed with the horse standing. Many different methods of casting and securing are used. I usually use the side line, cast on the left side, secure the hind feet and leave the fore feet free. The animal being ready, the operator will grasp a testicle in the left hand (if they are of uneven sizes, take the smaller one first; if of equal sizes, take the one farthest from you) press it tightly against the scrotum and make a bold, free incision, cutting through the scrotal and peritoneal coverings, when the testicle will pop out. It is then removed by whatever method is being adopted and the other testicle then taken in the same way. The following are some of the methods employed: viz., clams, torsion, actual cautery, ligature, ecraseur and emasculator. If the clams are used, after the testicle is exposed the operator will carefully cut off the nonvascular portion of the cord, then enclose the

vascular portion in a clam and cut the testicle off, using a clam for each cord, the clam to be removed in about thirty-six hours. I prefer either the ecraseur or the emasculator, in which case it is immaterial whether the nonvascular portion be cut with the knife or with the other instrument. After castration the animal is not to be exposed to wet or cold; he should have exercise, either by running at grass or being exercised in other ways; he should be kept in the stable at night for a week or ten days. If the colt should be castrated at a few weeks old, I do not consider it necessary to take such precautions against bleeding; all that is necessary is to divide the cord by a sort of scraping motion of a knife. The same plan answers for calves of a few weeks old. For the young of smaller animals, as the sheep and pig, I usually, after exposing the testicle and cutting the nonvascular portion of the cord off, pull the testicle steadily away without cutting the cord at all.

As a rule, when the operation has been carefully performed, no further treatment is required except the attention already mentioned, but in other cases, even after the most careful and skilful operation, untoward results will follow. The normal results of the operation are, a varying, but comparatively slight amount of swelling, more or less stiffness, and a discharge of serum and pus from the wounds for a few days. Some of the untoward results are,—hæmorrhage, excessive swelling, formation of abscesses, scirrhus cord, tetanus, peritonitis, fistula, etc.

In cases of excessive hæmorrhage the vessel must be ligatured if possible; if this cannot be done the scrotum may be stuffed with batton-saturated with the tincture of iron or other styptic. In excessive swelling, scarify the swollen parts and bathe with warm water, and exercise. If abscesses form they must be opened. If scirrhus cord forms it must be removed with the knife and ecraseur, etc. Tetanus and peritonitis must be treated as the same diseases resulting from other causes.

Fistula and scirrhus cord result from the same cause, viz., the cord becoming adhered to the scrotum and a

tumour growing. It usually results after castration with clams, when the clams are removed the adhesions should be broken down with the finger to prevent the growth of scirrhus.

DISEASES OF THE DIGESTIVE ORGANS.

With rare exceptions diseases of the digestive organs are the results of errors in feeding. I may here state that horses are best kept in health and working condition by feeding upon an admixture of food requiring thorough mastication, and horned cattle also by food requiring remastication, in addition to more nutritive material. The intestines of the horse are more subject to disease than the stomach, while the reverse is the case with the ox and sheep. The reason for this is that the stomach of a horse is a simple organ, and small in comparison to the volume of the intestines. The food is arrested for only a short time in it, soon passing on to the intestines where the chief part of the process of digestion takes place. In the ox and sheep the large and complicated stomach not only digests but also prepares the food for digestion, while the intestines have a much less volume than in the horse.

Chronic Indigestion, or indigestion without engorgement, occurs in the horse, the symptoms being a capricious appetite and a tendency to eat filth, with sourness of the mouth and increased thirst, the animal becomes hide bound, has a dry, scurfy skin, irregularity of the bowels and general unthriftiness. If caused by imperfectly masticated food it can be told by the fæces. Colicy pains are sometimes present an hour or two after feeding, whilst in others, giddiness, megrims, and even paralysis may occur.

CAUSES.—Improper food, the process of dentition, diseases of the teeth, voracious feeding, irregular feeding, debility of the stomach, etc.

TREATMENT.—Remove the cause if possible. If diarrhœa be not present, causing weakness, give a moderate purgative. After this has operated, give bicarbonate

of soda, gentian, sulphate of iron, and nux vomica, dr. doses of each twice a day, and feed carefully. If this treatment fails give muriatic acid, 1 to 2 drs. twice a day.

In the cow chronic indigestion is shown by recurring tympanitis and other symptoms similar to those of the horse, and when not due to any external cause is often found to be due to the presence of some foreign body in the rumen or reticulum, removable by the operation of rumenotomy.

Acute Indigestion, or indigestion with engorgement, may arise from repletion with solid food, or from the evolution of gases arising from the fermentation of food.

Causes.—Too much food, or food greedily swallowed and imperfectly masticated, feeding immediately after severe exercise or severe exercises too soon after feeding, wheat, peas, or a too sudden change of food, drinking large quantities of water shortly after feeding, etc.

Symptoms.—Uneasiness, stamping of the feet, lying down, getting up, etc., soon followed by fullness and tension of the belly, bloating, quick oppressed breathing, pulse at first quick and strong, becoming weaker as the disease advances, dullness and stupor, sweats bedew the body. The pain is usually continuous but of varying intensity, no disposition to eat or drink. In rare cases there is belching or even vomiting, the food escaping through the nose. More commonly vomiting implies rupture of the stomach, but it may occur without rupture. The symptoms of rupture are great prostration, with tremors of the muscles, heavy breathing, staggering, the pulse becomes weak and soon imperceptible, and the countenance haggard and dejected.

Treatment.—Give alkalines, as oil of turpentine, 2 to 4 fluid oz., and raw linseed oil, 1 pint. Good practice to foment the abdomen. Place in a comfortable box stall. Give injections per rectum. If the pain be severe give anodynes, as belladonna or chloral hydrate, 2 drs. of the solid extract of the former, or 2 fluid oz. of the fluid extract, or of chloral hydrate give 1 to 2 oz. Hypodermic injections of 1 to 1½ gr.

of eserine, and 2 to 3 grs. pylocarpine has an excellent action in causing expulsion of the gases and stimulating peristaltic action. If the dose given at first does not have the desired action, repeat in 1½ to 2 hours, and repeat again if necessary. If the bloating be excessive puncture on the right side, between the point of the hip and the last rib and allow the gas to escape. It is good practice to give a purgative after the acute symptoms are allayed. After administering a purgative for any disease do not allow anything to eat except a small quantity of soft food, as bran and water in small quantities given often, until the purgative begins to act, and do not let the animal be worked until his bowels regain their normal condition. A purgative should act in the horse in from 18 to 24 hours, in the ox a little sooner, but often they do not act as quickly as we expect, and I do not consider it safe to repeat the dose sooner than at least 48 hours, when a smaller dose may be given.

Hoven, Tympanitis or Blown in cattle, so called from the drum-like condition of the rumen. It is a distended state of the rumen, due to the elimination of gases from fermenting food.

Causes.—Over-doses of food, sudden changes of food, especially to that of a fermentable character, as frozen grass, turnip tops, fresh clover, etc., and to gorging the stomach, causing suspension of the peristaltic action. Diseases of the salivary glands, etc.

Symptoms.—Swelling of the left side of a springy, tympanic character, uneasiness, stamping of the feet, loss of appetite and rumination, secretion of milk suspended, difficult breathing, expansion of the nostrils, moaning and belching, etc. Unless relieved the animal may die from suffocation, rupture of the stomach or the diaphragm or from the absorption of the gases into the circulation.

Treatment.—If the bloating is not excessive give 2 to 4 fluid ozs. oil of turpentine and a pint of oil. If necessary repeat in an hour. If the bloating is excessive and immediate relief is necessary, puncture with a trochar and cannula on the left side, between

the point of the hip and the last rib. It will do to use a knife if the proper instrument cannot be had. It is a good practice to give a brisk purgative, as 1 to 3 lbs. Epsom-salt after an attack of tympanitis.

Impaction of the Rumen is that condition in which the rumen becomes filled with large quantities of food, which does not digest properly, nor yet form gases in large quantities as in the last mentioned disease. It is also caused by engorgement on mostly any food, changes of food, etc. The rumen becomes distended with the food and its walls become more or less paralysed and digestion suspended.

SYMPTOMS.—Much the same as tympanitis, but there is not such violent distension of the rumen and the breathing is not so much affected. The rumen has a doughy feel, instead of the springy feel as in tympanitis.

TREATMENT.—Give a brisk purgative as 1 to 3 lbs. Epsom-salt, followed by 2 dr. doses nux vomica three times a day. Repeat the physic if necessary in 48 hours. A little boiled flax seed can be given in the meantime, it helps to sustain the animal's strength, and aids the action of the purgative, and also makes a convenient vehicle in which to administer the powders. In some cases where the distension is great and the stomachic walls so paralysed that medicine will not act, RUMENOTOMY may be performed. It consists in placing the ox with the right side against a wall and securing him there; make an incision in the space between the point of the hip and the last rib, from above downwards and slightly forwards, right through the skin, muscles and walls of the rumen, placing a towel carefully into the rumen to prevent the contents from falling between it and the abdominal walls, removing the greater part of its contents with the hand, then removing the towel and suturing the walls with carbolised catgut. The abdominal muscles must then be sutured with the same, and the skin with ordinary suture. After the operation the animal must be fed on light, sloppy, easily digested food for about 10 days.

Grain Sick is simply impaction of the rumen with grain. When an animal is known to have had an

opportunity to eat large quantities of grain, do not wait for him to show symptoms of sickness before treatment, but give him a brisk purgative at once, restrict his food and give water in small quantities. The treatment for grain sick is the same as the last mentioned. If he appears to have eaten a very large quantity, it is well to perform rumenotomy at once, as the moisture of the stomach will cause the grain to swell, and distend the rumen to such an extent as to cause a complete cessation of digestion.

Impaction of the Omasum or Third Stomach.—Fardel-bound—Maw-bound—consists of impaction of food between the leaves of the manyplies, and is often followed by inflammation of the stomach. It is caused by the introduction into the stomach of indigestible food, particularly food of a dry, woody nature; old last year's grass, that is often taken along with the fresh grass in the spring, is very productive of fardel-bound. It is difficult to treat and often proves fatal.

Symptoms.—It often begins with diarrhœa, which is followed by obstinate constipation, appetite impaired, rumination ceases, secretion of milk more or less suspended, muzzle dry and eyes generally dull but sometimes wild looking, a short grunt is generally emitted during expiration, the breathing is quickened; pressure under the false ribs on the right side will generally cause pain; after a time there is sometimes more or less tympanitis formed by the food in the rumen; the animal often lies on its left side with its head turned towards the right flank; sometimes delirium more or less marked is noticed, and sometimes drowsiness and stupor or partial paralysis.

Treatment.—Give a brisk carthartic, as 1 to 3 lbs. Epsom-salt. It is good practice to give about an oz. of pulverised aloes in solution, as aloes appear to have a special action on the third stomach. (I may here state that it is good practice to give about half an oz. of ginger in combination with a physic, no matter what the disease is, as it prevents griping when the physic is acting.) Give nux vomica 3 times daily and give stimulants, as sweet spirits of nitre, or liquor, and encourage the animal to drink. If

the cathartic does not act, repeat in about 36 hours and so on until the bowels act freely. In this disease we find that after giving a physic we often get a passage of a small quantity of liquid fæces, and then the constipation is again well marked.

Paraplegia is a partial or total paralysis of the hind quarters, which sometimes occurs from diseases of the stomach.

SYMPTOMS.—Partial or complete inability to rise, with staggering gait if on the feet.

TREATMENT.—Give brisk cathartic and follow by **nux vomica.**

Indigestion in Calves, Lambs and Foals.—WHITE SCOURS may result from a variety of causes, such as feeding newly born calves on old calved cows' milk or on skim milk, feeding foals on cow's milk, ill health or improper treatment of dam, allowing foals to suckle when the dams are heated, long intervals between suckling and then taking large quantities, foreign bodies, as hair balls, etc., in the stomach, uncomfortable quarters, etc.

SYMPTOMS.—Irregular appetite, swollen, tender, drawn up abdomen, with a fœtid, watery discharge from the rectum, dry, scurfy skin and rapid emaciation.

TREATMENT.—Remove the cause. If not too weak give 1 to 4 oz. castor oil. If very weak give laudanum 1 to 3 fluid drs., brandy, 2 to 6 fluid drs., and catechu, 1 to 2 drs., according to the size of the patient, in a little of the mother's milk every two or three hours, until the scouring ceases. See that the patient gets good milk. Give linseed tea, to which add 1 to 2 fluid oz. of lime water, two or three times daily. In many cases, where the symptoms are not serious, the administration of lime water in linseed tea or the milk, is all that it is necessary to do.

Constipation of the Bowels may be looked upon more as a symptom than as a disease of itself. As long as the animal remains in good health no active measure need be taken, beyond prescribing a more laxative diet. It may be due to debility of the digestive and

secretory glands of the bowels. In such cases give iron and nux vomica. Paralysis of the bowels sometimes results, there will be no passage of fæces and no natural abdominal murmurs, and in some cases a non-contractile condition of the rectum. The appetite will be much impaired and the animal dull, but in the early stages no severe symptoms will be shown.

TREATMENT.—We must be careful about giving purgatives, as they might cause rupture or irritation of the bowels, on account of the paralysed condition of the bowels. Endeavour to overcome this by the administration of nux vomica and stimulants, and injections per rectum, then give a laxative, as linseed oil, 1 to 2 pints, followed by easily digested food and good care.

Spasmodic Colic consists of a spasmodic contraction of parts of the muscular coats of the small intestines, and sometimes the large. In many cases the neck of the bladder is also spasmodically contracted, when the animal will attempt to urinate if there be much urine in the bladder, but cannot succeed until the contraction is relieved.

CAUSES.—Improper food, changes in food or water when the animal is heated, exhaustion from overwork, particularly if associated with long fasting. Colicky pains are also symptomatic of other diseases which will be considered..

SYMPTOMS.—Sudden, and usually violent pains, pawing, kicking at the belly, looking around towards the flanks, lying down, rolling, struggling violently or lying outstretched, then suddenly rising, shaking himself and remaining free from pain for a time. The pains may or may not again appear, if so, the same symptoms are shown as at first. The pulse is very little affected except during the spasms, when it becomes excited. Sometimes there are frequent attempts made to urinate, which act cannot be accomplished if the neck of the bladder is suffering from spasm. This symptom gives rise to the idea that there is something seriously wrong with the urinary apparatus; as soon as the spasm is relieved the horse will urinate.

Small quantities of fæces are frequently passed during the spasms. These symptoms continue until the animal gets relief. Spasmodic colic has been known to cause death from exhaustion, and in some cases it is the forerunner of enteritis or other serious disease.

Treatment.—In most cases a spontaneous cure takes place without treatment in the course of half an hour or so, but it is advisable to treat by the administration of antispasmodics. The following is a favourite colic drench—1½ fluid oz. each of laudanum and sweet spirit of nitre and 1 fluid oz. of the fluid extract of belladonna and half a pint of water, the dose to be repeated if necessary in an hour, or instead of the above give any good antispasmodic, as chloral hydrate, chloroform, ether, etc. The hypodermic injection of about 3 to 5 grs. of morphia, or ¼ gr. of atropia answers well. It is well to give injections per rectum. It is good practice to administer a purgative after an attack of spasmodic colic. Some horses are very subject to colic, indigestion, etc. I find that feeding a tablespoon of ginger every night in their food will usually remove the tendency to the attacks by acting as a stomachic, and giving tone to the digestive glands of the stomach and intestines.

Flatulent Colic is much more serious than spasmodic. It consists of distension of the intestines with gas. The causes are much the same as those of spasmodic colic, especially should the food readily ferment. This and, I may say, mostly all intestinal diseases frequently appear without any recognisable cause, due, no doubt, to a nonactive condition of the digestive glands.

Symptoms.—The pain is not so suddenly shown and not so acute as in spasmodic colic, the abdomen becomes more or less distended with gas, better shown on the right side. The pulse, at first full and strong, becomes frequent and feeble, the breathing difficult, extremities cold, and there is generally twitching of the muscles. He generally lies down more carefully than in spasmodic. If relief be not afforded, death soon results from rupture of the intestine, asphyxia, or blood poisoning from the absorption of gases. It sometimes occurs during the progress of other diseases, indicating a very grave condition.

TREATMENT.—Give turpentine and oil to neutralize the gases; or the hypodermic injection of eserine. Give belladonna, choral hydrate, chloroform, or the hypodermic injection of morphia or atropia to relieve pain. Give injections per rectum. If the bloating be excessive and immediate relief is necessary puncture on the right side.

Impaction of the Colon results from overfeeding, especially with innutritious food; the food not being properly digested lodges in the colon. It may be due to weakness of the digestive organs, or inactivity of their glands, want of exercise, sudden changes of food, etc.

SYMPTOMS.—The condition may be present for some time without any serious symptoms being shown, then the animal suffers more or less from colicky pains; he frequently sits on his haunches, or while standing will press his rump against any solid object. He resists the introduction of the hand, or injections into the rectum, by violent straining. There will be little or no passage of fæces, and generally a fullness of the right side of the abdomen can be noticed. After a time gases are liable to form, when the fullness will be more prominent. There is generally a paralysis of the coats of the intestines. In the first stages the pulse is slightly accelerated, becoming more so as the disease advances.

TREATMENT.—Give a purgative, followed by nux vomica. Remove the fæces from the rectum by hand and give injections per rectum repeatedly. Some recommend the injection of a solution of aloes into the rectum. Combat pain by belladonna, chloral hydrate, or the hypodermic injections of morphia or atropia. Do not give opium as it would increase the constipation. If gases form treat accordingly.

Rupture of the Rectum sometimes occurs from disease of the blood vessels or the walls of the viscus, or from violence, as the foot of a fœtus being pushed through during parturition, etc., etc. If it occurs near the anus it may be stitched, and by feeding the animal on light, easily digested food, a cure may be effected. If the rupture should be far in it is hard to effect a cure.

Inversion of the Rectum is caused by violent straining during parturition, or impaction of the intestine, constipation, diarrhœa or dysentery.

SYMPTOMS.—There will be a greater or less protrusion of the intestine through the anus.

TREATMENT.—Remove all source of irritation, wash thoroughly with warm water, if much inflamed and swollen scarify and allow an escape of serum, oil the parts and return carefully to the natural position, and retain by a truss or by a suture across the anus. Restrict the diet and remove the fæces by hand, if necessary; relieve local irritation by opium. In cases where the bowel cannot be returned, dissect off the mucous membrane and then return. In some cases the anus contracts violently upon the gut, and, shutting off the blood supply, causes gangrene. In such cases remove the gangrenous parts with the knife, and suture carefully with catgut or carbolised silk.

Hæmorrhoids or Piles.—More frequently seen in dogs. They consist of dilation of the hæmorrhoidal veins, causing small tumours. These sometimes protrude outside of the anus and bleed profusely.

The SYMPTOMS are the switching of the tail, and the tendency to rub it against the wall, panting during the act of defecation, the fæces being tingled with blood. The dog sits on its haunches and pulls himself along the ground.

TREATMENT.—Give a laxative and restricted diet. Give enemas and apply astringents to the parts as 1 part oak galls to 4 parts of hog's lard. It is sometimes necessary to remove the piles with the ecraseur.

Enteritis—Inflammation of the Bowels—is one of the most fatal diseases to which horseflesh is liable. The seat of the inflammation is usually the mucous coat, but all may become involved as the disease progresses. In some cases it may terminate favourably in the horse, but in the majority of cases gangrene results, or the animal may die from hæmorrhage into the intestinal canal, or from exhaustion and pain. Gangrene may result in 8 or 10 hours, the animal rapidly succumbing, or it may live for some days.

Post-mortem appearances.—There are patches of darkened tissue approaching blackness, which may be only a few inches long, or may extend for a foot or more, and be associated with extravasation of blood into the canal. The mucous membrane can be easily stripped off.

Symptoms.—There may be general depression, rigours, anxious expression, quickened breathing and rapid evacuation of small quantities of fæces before abdominal pain is shown. The mucous membranes are deeply congested, the mouth dry and hot, appetite gone, the pulse hard, frequent and wiry, the belly tender upon pressure. He stamps with his feet, strikes at his belly, lies down carefully, may attempt to lie down several times; looks towards his flanks, pants, blows and sweats with pain. The pain is constant, distressing and agonizing. Sometimes he will stand persistently and paw for hours, pulse hard and frequent, from 80 to 100 or more, as the disease advances it becomes thready and imperceptible. He sighs or groans with pain, sweat runs off the body. The skin is never dry, at one time hot and then cold. The countenance becomes haggard, the eye expressive of delirium and the pupils dilated. He may now throw himself about in the most dangerous manner or walk incessantly around the stall, then stand and balance himself for a greater or less time, his legs give way and he falls in any direction, and expires. When gangrene sets in the pain will cease and he will stand quiet, drink water and even attempt to eat, the breathing becomes quieter, but the haggard expression remains and the pulse is imperceptible, cold sweats bedew the body, and the abdomen swells, legs and ears cold, breath cold and sometimes fœtid. Death soon ends the scene, the bowels remaining inactive to the last.

Treatment.—Opium is the great sheet anchor. The advisability of bleeding depends on the pulse, when it is full and strong it is good practice to bleed. In some cases the symptoms abate in a few hours and a recovery results. In treating a case of enteritis, give large doses of opium. The pulverized gum opium is preferable to the tincture, as it has not the stimulating effect, and

the idea is to keep the bowls as quiet as possible. Give 2 to 4 drs. every two hours in bolus or solution. Fomentations constantly applied to the abdomen is serviceable.

Volvulus and Intussusception.—Under these names various entanglements of the bowels have been described, giving rise to abdominal pain, enteritis and death. Volvulus is a rolling on itself of a piece of intestine until nothing can pass through, a knot as it were. Intussusception is the slipping of a portion of bowel into the portion immediately behind it, like the drawing of a finger of a glove into itself. Cases of recovering from the latter are recorded, in which the portion of the bowel has sloughed off, and passed off per rectum, the remaining portion healing.

SYMPTOMS are the same as obstinate constipation. No treatment can be recommended.

Intestinal Concretions.—Their most usual seat is the large intestine, where they sometime sattain a large size, and as much as 25 lbs. or more in weight. They have been found in the stomach, 4 or 5 lbs. in weight. Some are composed of phosphates (phosphatic calculi) ; these are hard, smooth and polished, having a nucleus, generally a piece of iron or stone ; others, composed of beards of grain, hair, or other indigestible matters, often mixed with phosphatic salts, assuming the same shape as the first.

SYMPTOMS.—Colicky pains and obstruction of the bowels. Their presence can only be suspected by recurrent attacks of colic, etc. They can sometimes be felt and removed by the hand per rectum, which shows the advisability of making rectal examination in all cases of abdominal pain.

Diarrhœa is the term applied to the frequent passage of liquid fæces without co-existent inflammation. It may be a spontaneous effort to discharge from the intestines something that is obnoxious to them, and to the system generally. It is induced in all animals by a variety of causes, such as indigestible food, sudden changes of diet, particularly from a dry to a moist one, medicinal substances, parasites, derangement of the liver, copious draughts of water when the animal is heated, foreign

matter in the intestines, etc. Some animals are very prone to diarrhœa from trivial causes, as those of nervous temperament; flat-sided, narrow-loined, loosely-coupled horses purge on going a journey and are hard to keep in condition. Horses of this kind are said to be washy.

Treatment.—When the trouble is due to some offending matter in the intestines, its expulsion must be aided by a moderate dose of castor or linseed oil, and the diet must be changed. If the bowels do not acquire their normal condition after the laxative has acted, astringents, as catechu, opium and chalk, must be carefully given, as 1 oz. tinct. of opium, 4 drs. each chalk and catechu in a pint of water every 4 hours until the diarrhœa ceases. Thirst is usually excessive, and a little flour or starch can be given frequently in small quantities of water. If the animal be much depressed, nitrous ether or brandy may be given every two or three hours. Feed dry hay and oats ; keep quiet and comfortable.

Dysentery.—While acute diarrhœa most commonly attacks the horse, chronic diarrhœa and dysentery are much more common in cattle and dogs. It consists in an inflammation, having a tendency to terminate in ulceration of the mucous membrane and glandular structures of the intestines. It appears in both an acute and chronic form, the chronic in horned cattle being often dependent upon a scrofulous diathesis with tubercular deposits and ulceration of the intestinal glands. Acute dysentery is not often seen, except as a concomitant to other diseases, but may be induced by bad food and putrid water. The symptoms of acute dysentery are shivering fits, variable temperature of the body, arching of the back, clammy mouth ; the animal grunts, yawns and grinds his teeth, and at short intervals discharges per rectum a quantity of thin material mixed with pellets of hardened fæces and blood. There is much straining and irritation of the anus and rectum, which appear red and sore. Abdominal pain is shown by the whisking of the tail and pawing. Tympanitis is sometimes present, great dullness, thirst and rapid emaciation. In the chronic form there is emaciation, looseness of the teeth, and dropsical

swellings, the fæces are tinged with blood and contain much mucous, and after a time an admixture of fœtid, purulent matter. The fæces are discharged involuntarily, the eyes become dim and sunken into the sockets, and the animal dies.

Treatment.—In both forms give mild oleaginous purgatives, succeeded by opium, and antacids as the bicarbonates of soda and ammonia. Should these not succeed treat as for diarrhœa. To overcome the fœtor of the fæces give the hyposulphite of soda in 3 to 4 dr. doses three times daily. In the chronic form cod liver oil is serviceable. The diet must be nutritious.

Azoturia is a hypernitrogenous condition of the blood throughout the system, peculiar to the horse.

Causes.—Excess of nitrogenous food, with want of exercise.

Symptoms.—After a varying period of idleness, during which time the animal has been tolerably well fed, he is taken out to drive or work, he, as a rule, feeling more lively than usual. After having travelled some distance from a few rods to a few miles, he suddenly becomes dull, may go very lame in one or both hind legs, as though he had picked a nail, sweats profusely, staggers and sometimes exhibits colicky pains, sometimes there is complete loss of power to move, he falls and is unable to rise. Usually there is a very tense and hard swelling of the muscles over the loins. If the urine be drawn it is found to be coffee coloured or almost black. If the horse be down he is generally uneasy for a time, throwing himself about violently. If on his feet he will try very hard to remain standing. In some cases he is able to retain a standing position, when the case is not so severe. The brain and spinal cord are generally more or less affected, causing more or less delirium and paralysis.

Treatment is often successful. If standing give a purgative, and bleed. Endeavour to keep standing if possible. Apply mustard over the loins and clothe warmly. If much uneasiness is shown give anodynes, as belladonna or chloral hydrate ; give injections per rectum. About the second day give nitrate of potash

in 3 dr. doses in water.. If the horse be down make comfortable and prevent him from injuring himself. Give a purgative, draw off the urine and turn from side to side every seven or eight hours. Give potassium nitrate about the second day; in three or four days endeavour to get him on his feet and use slings if necessary, and give nux vomica in 2 dr. doses, three times daily, to overcome the paralysis.

DISEASES OF THE RESPIRATORY ORGANS.

Catarrh or Common Cold.—Symptoms, sneezing, discharge of a watery material from the nostrils, redness and dryness of the mucous membrane of the nose, the discharge becomes thick, whitish and profuse, fever, dullness and debility, impaired appetite.

Causes.—Exposure, ill-ventilation, sudden changes of temperature. Animals are very liable during the time of changing the coat, and young animals when brought into warm stables often suffer from it. It is sometimes complicated with laryngitis, and if neglected it often spreads over the whole respiratory tract.

Treatment.—Place in a comfortable, well-ventilated box-stall, clothe according to the weather, allow plenty fresh air, but exclude draughts, feed on laxative diet, steam the nostrils by holding the head over a bucket of hot water and stir with a wisp of straw, give nitrate or chlorate of potash in 2 dr. doses, 3 times daily, to subdue fever, followed by tonics and good food, don't purge, give injections per rectum if the bowels be costive.

Acute Laryngitis is an inflammation of the lining membrane of the larynx. It is not an uncommon nor yet a non-important disease, as it sometimes kills very quickly. There is great tendency to submucous effusion, and this, together with the formation of mucous on the free surface of the mucous membrane is apt to cause closure of the glottal opening, and death from asphyxia.

Symptoms.—At first a dry cough, difficulty in swallowing, the water returning through the nostrils. It is often accompanied with pharyngitis. There is generally a discharge from the nostrils even in the first stages, at first watery but soon becoming thicker and whitish. Sometimes the nose is protruded ; there is difficulty in breathing, shown by a harsh sound being emitted. There is generally more or less swelling of the neighbouring glands, and soreness on pressure of the parts, which causes the animal to cough. In severe cases the breathing can be heard for a considerable distance. The eyes become prominent, frequently we have swelling of the legs and apparent soreness of the joints. The mucous membrane of the eye is injected and often there is a flow of tears. In the later stages the cough becomes hoarse and gurgling. The temperature is increased, and the appetite impaired. The animal will generally stand persistently, and if possible with his nostrils where fresh air is plentiful. I may here state, that in mostly all respiratory diseases the patient stands mostly all the time.

Treatment.—In mild cases good care will generally suffice, as mostly all these fevers must run their course, and we endeavour to assist nature. Apply ammoniacal liniment to the throat, steam the nostrils, apply a hot poultice to the throat, or apply dry heat ; give chlorate of potash in 2 dr. doses three times daily ; give soft food ; give milk and eggs to drink if he can't eat. Hold the pail up high, feed out of a high manger, make comfortable. Must not force medicine down ; follow by tonics and stimulants. If necessary perform tracheotomy. Sequels—thickening or ulceration of mucous membrane ; atrophy of the laryngeal muscles ; either condition causing roaring or whistling. Thickening is best treated by iodide of potash internally ; ulceration by applying a solution of silver nitrate with a sponge on a rod. For atrophy of the muscles nothing can be done.

Roaring is a wheezing, whistling or hoarse sound made in the larynx in breathing, especially during excitement. It is usually due to paralysis or atrophy of the muscles of the left side of the larynx, this

condition decreasing the calibre, the noise being made during inspiration. But any obstruction in the large air tubes may cause roaring, heard most commonly both during inspiration and expiration, such as fracture and depression of the nasal bones, polypi, osseous or other tumours, thickening of the mucous membrane, a false membrane, etc. The roarer often has a cough of a loud, hoarse, dry character, and is generally a grunter. An animal should always be subjected to severe exercise in examinations for soundness before an opinion is given.

Treatment.—If due to any removable cause, of course remove it ; but if due to atrophy of the muscles, as is usually the case, not much can be done. In the early stages benefit may be derived from blistering or firing the throat, or giving chlorate of potash. Electricity has been found beneficial. The sounds may be modified by pressure in the shape of pads attached to the bridle so as to press on the false nostrils. Tracheotomy may be performed in extreme cases. It is sometimes performed in racehorses.

Croup is a form of inflammation of the throat, characterised by the formation of a false membrane of a greyish white colour. It is generally seen in calves, lambs and foals subjected to cold, damp or high exposed localities.

Symptoms.—Sore throat, coming on suddenly with hard, croupy cough and dry, wheezing breathing, worse at one time than another. The false membrane is discharged in shreds on the second or third day. Fever runs high, with quickened pulse.

Treatment.—If there is danger of suffocation, perform tracheotomy. In milder cases, steam the nostrils with hot water and a little carbolic acid. Apply a solution of nitrate of silver, ½ dr. to one fluid oz. of water. Give nitrate of potash and soda hypo-sulphite in water. If there is much prostration, give nitrous ether, give oil if indicated, and make comfortable.

Bronchitis or inflammation of the air tubes leading to the air cells.

CAUSES.—The same as catarrh or laryngitis, or an extension of the inflammation in those diseases. It is often caused by worms in the tubes or by the introduction into them of smoke or other foreign bodies, or of medicine carelessly administered, when it is called mechanical bronchitis.

SYMPTOMS.—At first there is a dryness, narrowing and rigidity, and subsequently moisture, dilatation and relaxation of the tubes. Owing to these changes, the vibrating sounds caused by the passage of air through the inflamed tubes undergo variations, which indicate pretty clearly the dry or moist condition of the parts. At first there is a hoarse, ringing, loud, dry cough, which becomes moist as the disease advances. The respirations are greatly accelerated and out of all proportion to the pulse, and of a short, quick character. The animal is dull, listless, hangs his head, and is generally thirsty; temperature increased, a ropy saliva fills the mouth, the mucous membranes are injected, the animal stands in a corner or moves aimlessly about. If in a box with the door open, he stands with his head to the open air. Bowels costive, urine scanty. There is a loud noise over the windpipe and behind the shoulder blade, which after three or four days becomes less harsh and blowing, but with a slight rattle from bursting bubbles; the cough becomes soft and rattling. The animal stands obstinately.

TREATMENT.—Attention to the surroundings and clothing, sloppy food, a dose of opium in the first stages if there is irritability. The inhalation of a little carbolised steam; give all the cold water he will take, with nitrate of potash dissolved in it. In the second stages give ale or gruel if the administration does not cause coughing; give enemas and a little oil if constipated. Apply counter-irritation, as mustard, to the trachea and breast. As soon as fever has subsided, give tonics, as iron and gentian.

Congestion of the Lungs—Pulmonary Apoplexy—consists of an engorgement of the functional vessels of the lungs, due to a weakened condition of the heart from over-exhaustion, especially when not in a fit condition, and is occasionally due to exposure to cold.

Symptoms.—The animal stands with outstretched legs and seems to fight for breath, nostrils dilated, flanks heaving, trembling of the body, legs and ears cold, cold sweats bedew the body, mucous membranes injected, pulse small and indistinct and frequent. Heart's action tumultuous.

Treatment.—Place in a well-ventilated box, allow plenty pure air, give stimulants, rub the body and limbs, and apply bandages ; clothe the body warmly but not too heavily ; four or five quarts of blood may be drawn, and a stimulant given to keep up the heart's action. Pneumonia may follow.

Post-mortem Appearances.—The lungs somewhat resemble the spleen, and when cut into present a deep, dark purple colour ; the vessels are filled with dark blood of a tarry nature. The lungs will generally float in water, thus differing from pneumonia. (Must not be taken for hypostatic congestion, which may occur post-mortem or during the death struggle, and always appears in the most dependent parts of the lungs.)

Pneumonia or Inflammation of the Lungs differs from congestion, in which we have strangulation of the functional vessels, but in inflammation there is an effusion from the vessels and a general alteration of the lung tissue.

Causes are the same as the other acute diseases of the chest, and as a consequence of congestion or of parasites or other foreign bodies in the lungs.

Symptoms.—It is generally ushered in by rigours, accelerated pulse 50 to 80, the temperature 103 to 104 or even higher ; dry, deep cough ; coldness of the extremities ; the animal wanders about in a depressed manner, or stands in one position for hours ; appetite almost lost ; mucous membranes injected. For the first few days the respirations may not be more than five or six over normal, and they may rise as high as 30 or 40. If complicated with pleurisy there is more pain, but in pure pneumonia there is an absence of painful symptoms. The signs revealed by osculation are in the first stages small crepitations, indicating

dryness of the lung tissue ; secondly, absence of sound, indicating engorgement and consolidation ; thirdly, the reappearance of the crepitation now of a longer character, pointing out that the exudate is undergoing change and becoming absorbed, and he will generally stand with legs outstretched and nose protuded. During all the stages increased dullness is elicited by percussion. The inflammation is generally confined to one lung, and that the right ; but is sometimes seen in both, and is often fatal. After the first stage the cough becomes moist, and in the later stages there is generally a fœtid breath, indicating gangrene of the lung tissue.

Treatment.—Make comfortable. In the first stages, when the pulse is full and strong, bleed or give ten drops of Fleming's tincture of aconite every two hours for five or six doses, or until the pulse is lowered. Allow cold water with nitrate of potash in it. Apply blankets wrung out of hot water to the chest, or apply a mustard plaster and wash off in five or six hours. When the pulse begins to get weak, give stimulants, as 5 or 6 oz. of whisky three times daily. Give laxative, nutritive food. If constipation is threatened, give injections per rectum. If he won't eat, give milk and eggs, which he will generally drink if not allowed water for a few hours. When convalescence begins and fever subsides, give tonics and be very careful of the animal, as a recurrence or relapse is easily caused. In this, as in all respiratory diseases, be very careful in giving purgatives as they act very severely. When necessary to give a laxative, oil is preferable to aloes.

Pleurisy is partial or general inflammation of the pleura. It may be either double or single, generally single and confined to the right side. Causes are the same as other chest affections.

Symptoms.—It is generally ushered in by a chill, shown by a staring coat, coldness of the surface of the body and extremities, succeeded by signs of pain, often mistaken for colic, during which the horse paws and perhaps lies down and rolls, etc. He soon becomes stiff and sore, and if made to move or rapped on the affected side, groans. The respirations are rapid and

incomplete, the ribs are fixed. He persists in standing. Respirations are mostly abdominal, a well-marked line will be noticed from the false ribs to the anterior spine of the ileum. There is a short, dry, painful cough, pulse hard and quick. It is often associated with pleurodynia or inflammation of the intercostal muscles, when the animal moves in a very rigid manner, steps slowly and short, is greatly dejected, the back is arched, the skin shows tenderness on pressure. Hydrothorax or water in the chest is generally present, especially after the first stage, and it consists of a serum, which is the result of inflammation. Then the pulse becomes small, frequent and soft. There is absence of sound in the lower parts of the chest, or a sound like that of drops of water falling into a well. It is followed by an improvement of the pleuretic symptoms at first, but if this outpouring of serum continue, the difficulty in breathing becomes much increased. Dropsical swellings sometimes appear along the abdomen and in the legs.

Treatment.—If there is much pain give opium in a pint of linseed oil. If pain continue the opium may be repeated. After pain ceases, if the pulse remains strong, give aconite. Fomentations to sides, succeeded by mustard or strong liniment, repeat the mustard if necessary, give potassium nitrate in water or potassium iodide in dr. doses. When the pulse becomes weak, give stimulants, give good food and attend to comfort. If much effusion takes place tap with trocar and cannula, and draw the fluid off, puncture in the 8th or 9th intercostal space at the anterior border of the rib. When convalescence commences give tonics and good food.

Strangles, or Distemper, is an eruptive fever peculiar to the horse. It occurs in a regular form called regular strangles, and in an irregular form called irregular strangles.

Symptoms of first form : Unthriftiness, cough, fever, more or less inability to swallow, discharge from the nostrils, swelling between the jaws or of the throat, which is painful, becoming soft in the centre in a few days, and soon bursting. This form generally passes off in a week or ten days.

The irregular form may appear as a sequel to the former or may appear independently, there being the same systemic symptoms, but abscesses form in different parts of the lymphatic glands; abscess after abscess may form in any part of the body, the result varying according to the importance of the organ attacked, being frequently fatal. Is due to a poisonous matter in the system, which may be generated within or introduced from without. Most horses suffer from strangles at some age, generally before four years old. It is generally considered contagious.

TREATMENT.—Attend to comfort, give soft nutritious food, steam the nostrils, poultice the throat, and apply ammoniacal liniment. Give hyposulphite of soda 1 to 3 dr. doses three times daily, if the appetite is gone give milk and eggs, open the abscesses and treat after opening as an ordinary wound, by keeping clean and injecting white, or carbolic lotion. If necessary perform tracheotomy. Follow up with tonics and good food.

Purpura Hæ norrhagica is an eruptive non-contagious fever, usually occurring as a sequel to some other disease; generally following some debilitating disease of the respiratory organs.

SYMPTOMS.—An animal that is supposed to have about recovered from some respiratory disease is noticed to be stiff and sore, with swelling of the limbs, which generally extends rapidly. The swellings are peculiar, always ending abruptly as though a cord had been tied around the limb. There is often a swelling of the face and nostrils, small purple spots appear on the Schniderian membrane, and in the mouth and tongue, and in white-legged horses they can also be noticed on the limbs. After a day or two there is an escape of a purple fluid from these spots. The animal stands in one position for days, the bowels are constipated and the urine scanty and high coloured; appetite gone, the mucous membranes all of a purple colour. The swellings increase, as also does the discharge, until the animal becomes a most disgusting sight; breathing is difficult according to the amount of the swellings, and he dies of suffocation or exhaustion.

Treatment.—Give 2 oz. turpentine and 10 oz. of oil once a day, give [illegible] ½ oz. chlorate of potash three times daily, bathe the nostrils and legs with cold water. Attend to comfort; give good food and tonics.

Grub in the Head in Sheep.—A disease of sheep frequently met with, and commonly called grub in the head, is caused in the following manner: During hot weather (fly time) the common bot fly of the sheep (œstrus ovis) deposits its eggs in the nostrils of the sheep. The young larvæ make their way to the sinuses of the head and lodge there for development. During the coming months the larvæ develop into grubs, and by the warm weather of the following spring are ready to vacate their habitation. Having escaped to the ground they burrow in the earth until they become flies and are ready to attack the sheep as did their progenitors the preceding summer. During the development of the larvæ in sinuses of the head, and especially during the later stages, they often cause the sheep great distress, manifested by sneezing and coughing, shaking of the head, a discharge of mucous from the nostrils which causes snuffling. The affected animals often isolate themselves from the rest of the flock, the appetite is much impaired, and general emaciation is soon apparent. Unless relief be attained, either by the spontaneous escape of the grub, or otherwise, it will cause the animal's death.

Treatment.—Fumigating with burning sulphur will often give relief. This is done by placing the sheep in a close room and burning sulphur until the room becomes filled with its fumes, the animal inhaling the fumes destroys the grubs and they escape through the nostrils. Another, and probably, a better, mode of treatment is to make a mixture of one part oil turpentine and four parts sweet milk, agitate until the turpentine is thoroughly mixed with the milk then take an ounce syringe, to the point of which is attached a rubber tube about two inches long, fill the syringe with the mixture, have an assistant hold the sheep on her rump with the nose elevated, insert the tube into the nostril and empty the syringe quickly. Let the head down immediately after the injection, and after the animal ceases coughing inject the other nostril.

Wool Balls in the Stomach of Lambs.—A great many lambs (especially early ones), die suddenly every year and the owner is often at a loss to find out the cause. A post-mortem will often reveal a ball of wool in the fourth stomach, which stops up the pylorus and causes death, often very suddenly; in other cases, when the ball is movable, the animal is noticed to not be thriving for a greater or less time before death. The trouble is caused by the ewes not giving a sufficient quantity of milk to satisfy the hunger of her lamb or lambs, and the little fellows will get nibbling and sucking the mother's wool, a few fibres of which are taken into the stomach at a time, they generally reach the fourth stomach and remain there, where they gradually accumulate and form a ball until it gains sufficient size to stop up the pylorus and cause death.

Treatment is of no avail when once the wool gains the stomach. Preventive treatment consists in seeing that the lambs obtain sufficient nourishment. If the ewe has not sufficient milk they must be fed cow's milk, and as soon as they will eat, they should get roots, finely pulped.

Tuberculosis, Pining or Consumption, consists in the presence of minute tumours or tubercles in different parts of the body, having especial preference for the respiratory organs and glands; it is infectious. It is seldom seen in horses; cattle are the most prone, then pigs and sheep.

Causes.—It is due to the presence of minute animal organisms called the bacillus of tubercle, and is produced in any way that these gain access to the system, either by contagion or infection.

Symptoms.—The symptoms of tuberculosis are very insidious, the disease, in many cases, existing in an animal without any symptoms being shown which would lead to the belief that the animal is affected. As almost any organ is liable to be affected, the symptoms will depend upon the organ or organs attacked, and also upon the extent of the disease in that organ or organs, no visible symptoms being present until the disease has reached a sufficient stage of development to interfere with the functions of the organ. In some cases a

number of organs are involved, thus complicating the symptoms. In some cases, as stated, no symptoms are noticed, while in others there is unthriftiness, dry staring coat, capricious appetite, irregular digestion, occasional tympanitis, diarrhœa and constipation, followed by emaciation. The temperature of a tubercular animal is generally higher than normal, but this is not always the case. When the lungs are involved there is usually a cough of a dry, short hacking nature, and if the disease be very extensive there will be more or less difficult breathing. The pulmonary symptoms will, of course, depend upon the extent of their derangement. If the digestive organs be attacked there will be digestive derangement as soon as the disease is sufficiently advanced to interfere with their functions. An animal may be affected for a long time without showing any positive symptoms. Sometimes the muscles are the seat of the disease. Then it is called muscular tuberculosis.

Treatment is useless. Isolate all suspected animals, and as soon as positive symptoms appear slaughter them and burn the carcases; or use Professor Koch's tuberculin as a diagnostic medium. The test is made as follows: Take the animal's temperature; it is good practice to take the temperature occasionally for a few days before testing, of course keeping a record of the date and hour at which it is taken. Take the temperature immediately before commencing the test. Sterilize the hypodermic syringe and needle, and the point of injection (I usually select the loose skin just behind the scapula) with a 5 per cent. solution of creolin or other good disinfectant, then inject hypodermically from 50 to 70 drops (according to the size of the animal) for a young animal use less, of a 10 per cent. solution of tuberculin in a 1 per cent. solution of carbolic acid. The animal's temperature then should be taken every three hours for the space of twenty-four hours. If in the meantime the temperature should rise two degrees or more above the starting point it indicates that the animal is diseased; if there should be only a slight degree of increase of temperature, less than two degrees, the indications

are that the animal is free from the disease. I have found the test very correct. The increase in temperature is called "the reaction."

Post-mortem Appearances.—The tubercles may be found in any organ, and vary in size from a millet seed to that of a bean, but they often congregate together and form very large masses. In the first stages they are hard and greyish in colour, but afterwards soften in the centre, becoming yellow, soft and cheesy in character. Masses of them degenerate in this way, showing large masses of creamy matter. In some cases the tubercles are very small and hard to find, "although the reaction may have been well shown during the test," and as any organ, even the brain or spinal cord, is liable to be the seat, a very careful post-mortem is necessary in order to discover the disease.

VETERINARY ANATOMY

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Short Notes on
VETERINARY ANATOMY.

VETERINARY means belonging to beasts of burden.

Anatomy is the science of organization. Animal Anatomy or Zootomy, has for its object the investigation of the animal frame, an investigation conducted by mechanically dividing it into its component parts and studying their form, structure, attachments and relations.

Anatomy may be comparative, special, or transcendental, according to the scope and ultimate object in view. Thus, if more than one species of animal be under consideration, the comparative anatomist takes note of the various deviations and similarities; but if the investigations be confined to one species of animal, as in human anatomy, the subject then becomes special. When special anatomy leads to the thorough investigation of one single variety, for the purpose of comparing other classes with it, the subject of such special study is called a type.

Comparative Anatomy, therefore, is not studied by the indiscriminate comparison of one type with another, but by referring them to certain types or standards. The horse is taken as the type by the Veterinary Anatomist, embracing as it does the structural investigation of the whole animal kingdom. Comparative Anatomy is closely related to the science of Zoology, the latter science aiming specially at the attainment of a scientific method of classification.

Transcendental, or Philosophical Anatomy, seeks for analogies and developmental facts which may guide the investigator in his search after primary anatomical types. Since the prosecution of such a study must assume a more or less profound knowledge of Comparative Anatomy we merely mention it in passing.

If we consider a portion of the animal body with respect to its form, size, relative position or structure, we are said to consider it anatomically; but should we enquire into the use or function of such a part, or seek to learn the changes undergone in it while in a living condition, then we are investigating physiologically. This is a general distinction between anatomy and physiology, but it will readily be seen that they are to a great extent bound up in one another, since both the sciences must lend their aid to afford a complete description of any given organ or part. The branch treating solely of structure and form is called Morphology. Histology, or minute anatomy, treats of the intimate structure of the tissues or materials of which the various parts of the body are composed. As the tissues present various characteristics invisible to the naked eye the histologist uses the microscope largely in his investigations.

Embryology, from an anatomical point of view, is a science considering the various appearances presented by an animal after each of the many successive stages of development, from when it first appears as a mere speck of vitality until it has acquired the general characteristics of a perfect animal.

Anatomy, in all the above mentioned branches, deals only with normal or healthy material; but should such material be in a diseased condition, the consideration of the changes it has undergone is termed Morbid Anatomy. Surgical Anatomy embraces the description and investigation of such parts of the body as are most liable to be involved in surgical operations.

Anatomy may be descriptive or practical. In the former the student relies on books, diagrams, lectures, etc., for his information; in the latter he verifies description by actual dissection and demonstration of the various structures in question. Veterinary Anatomy, in the full sense of the word, includes the anatomy of all domesticated animals, and is therefore a branch of Comparative Anatomy, and the animal referred to as its type is the horse, the anatomy of which (or Hippotomy) we will consider, while the deviations from this type in other animals we will notice as fully as the scope of our work will permit.

Anatomy is a very important branch of study. It is part of the foundation upon which a knowledge of disease must be based, for if we do not understand the normal or healthy structure of a part we cannot appreciate the changes which take place in disease. To some, anatomy appears a dry subject, but apart from the practical object we have in view, much interest may be excited by the beauties of nature's designs as they become unravelled step by step. In this course we cannot give much more than an outline, but will endeavour to give enough to enable you to understand the nature of the diseases and injuries that we study.

In addition, we consider that the knowledge of anatomy the student will attain here will enable him to study the points, characteristics and conformation of animals with greater ease and more thoroughly.

The animal kingdom is divided into the sub-kingdoms Invertebrata and Vertebrata. As the names imply, the latter is distinguished from the former by its members possessing a vertebral column or backbone, which forms, as it were, the axis of a bony framework, supports the head, and is placed dorsally, or in the region of the back, extending from one end of the body to the other. It is pierced throughout the greater portion of its length by a canal called the neural canal, which is continuous with a cavity in the head called the cranium. These cavities are occupied by centres from which radiate a large series of nerves termed the cerebro-spinal system. Underneath the backbone there is a second series of nerve centres, called the sympathetic system. Thus, in a vertebrate animal there are two systems of nerves whose centres are separated by a partition of bone. The remaining portion of the animal body may be regarded as a second cavity, or canal, which contains, in addition to the sympathetic system of nerves, the alimentary and the hæmal systems. The former runs the whole length of the body, being a canal which gives passage to the food ; the latter consists of a series of tubes by which the blood passes through the body ; both systems being supplied with many accessory organs.

In the higher invertebrate animal we find no backbone, no neural canal, and no cerebro-spinal system of nerves, but the visceral canal exists and its contents

correspond mostly with the structures found in the vertebrate.

If we eliminate from the vertebrata all the classes but the two highest—the mammalia and aves—we shall further localise our subject, since the two classes contain all the animals which, as a rule, engage the attention of the veterinary anatomist, to whom the first of the two is of by far the greater importance. It is sufficient to state that mammalia are characterized by the females being provided with an apparatus which supplies milk for the nourishment of their young after birth. Aves (or birds) are distinguished from mammals by their producing their young oviparously, or by hatching the egg outside the body. They never suckle their young, and have a covering of feathers.

Descriptive Anatomy.

Osteology is the term applied to that section which treats of bones.

Arthrology, a consideration of the joints.

Myology, the muscles.

Splanchnology, the viscera.

Angiology, the circulatory and absorbent system.

Neurology, the nervous system.

Esthesiology, the organs of sense.

Embryology, of the animal before birth.

The terms *analogy* and *homology* are frequently used and the following distinctions between the terms may be noted; Organs are said to be analogous when, though differing in structure, they perform the same function; but when their functions are different, while in the broad sense they correspond in structure or form, they are said to be homologous. Thus, the middle finger of the human hand is the homologue of the anterior digit of the horse, because they have the same general structure and relation to the rest of the limb; but as the functions they perform are quite different, they cannot be termed analogous. And then the lungs of a mammal are analogous to the gills of a fish, for though they differ widely in structure, position and form, and are therefore not homologous, their ultimate use is the same, each of them being an apparatus in which is carried on the process of purifying the blood.

Osteology.

Structure of bones. Bones are hard, yellowish-white bodies which form the internal skeleton, give attachment to soft structures and are of various sizes, forms and densities. In the limbs the bones are generally more or less cylindrical, with expanded extremities; they support the body, afford leverage and attachment to the muscles, and form the basis to all joints. Where cavities such as the cranium, chest and pelvis, enclose viscera requiring protection and support, the bones assume a flat, expanded form. Living bone is bluish-white, insensitive and elastic; exposed to the air it becomes diseased, assumes a black or livid hue and is extremely sensitive and painful. The teeth excepted, it is harder and of a higher specific gravity than any other animal tissue. It consists of inorganic salts deposited in a basis of animal matter. It owes its density and hardness to the former, its elasticity and tenacity to the latter, the union rendering the tissue solid and elastic. By steeping bone in dilute hydrochloric or other strong mineral acid, the earthy matter is dissolved, while the tough flexible animal cast is left. If we expose bone to the action of heat we get rid of the animal matter, while a white, brittle, earthy, chalky substance is left, retaining its original shape.

The relative proportions of animal and earthy matter vary at different periods of life. As an animal grows old the animal matter decreases, hence the bones of very old animals are brittle and easily fractured. The animal and earthy proportions do not vary in true bone tissues, but there is a gradual filling up of the cavities originally occupied by fat cells, thus condensing the bone. The earthy ingredients consist chiefly of carbonate and phosphate of lime, the animal matter of cartilage and connective tissue, vessels, lining membranes and a quantity of fat.

The following is the average analysis of the femur of a six-year-old horse:

Phosphate of lime (with traces of Fluoride Calcium)	54.37
Carbonate of lime	12.00
Phosphate of magnesia	1.83
Soluable salts	.70
Cartilage	27.99
Fat, etc.	3.11
	100.00

The bones of young animals may have too great a proportion of animal matter, when they give way under the weight, as in rachitis. The degree of hardness varies not only with age but also with the class of animal; the bones of birds being white, hard and brittle, especially those of the wings and legs, whereas fish bones are soft and flexible. They also vary in different parts of the same skeleton, the petrosal bone being the hardest one in the body while the ribs are soft and flexible.

The leg bones of a thoroughbred horse are more compact than those of a heavy cart horse. The latter are larger but do not weigh as much in proportion, because the shell or outer layer is more expanded and thinner, affording greater surface for muscular attachment; whereas in the thoroughbred a greater density of bone is necessary to withstand the immense concussion of speedy action, therefore the bones are increased in thickness of shell, affording greater strength without apparent increase of size.

Osseous Tissue.

In bone there are two modifications of texture, the compact and the cancellated. The former, hard, dense and ivory-like, is always situated externally; the latter, porous and spongy, lies within. Compact tissue appears uniformly dense, but if we cut a bone transversely and examine with a microscope it is found to contain numerous small openings called Haversian canals for the transmission of blood vessels, which run in a longitudinal or slightly oblique direction, opening on either the outer or inner surface of the bone. They also have many transverse branches of communication which are often of greater diameter than the trunks. These canals are from 1-200 to 1-1000 of an inch in diameter and surrounded by concentric layers or lamella of bone. Among them can be seen small dark bodies (lacunæ) filled with fluid from which pass radiating lines (canalicula) which establish communication between the Haversian canals and the lacunæ. On the external part of the shell of the compact tissue of long bones are several concentric osseous layers (the peripheral lamella) passing completely around the shaft. There is also a corresponding concentric disposition of

layers on the inner or medullary surface. Both these systems of lamella are in a great measure destitute of Haversian canals, and are supplied with nutritive material by means of lacunæ and canalicula as in the compact tissue generally. Each Haversian canal may be considered a vascular longitudinal centre, round which successive concentric layers of bone are arranged so as to form a dense cylindrical ossicle. Series of these are repeated, and united by lamella destitute of canals, but with numerous canalicula and lacunæ and called the connecting or interstitial lamella, the entire structure being encircled by the external peripheral lamella. Cancellated or spongy tissue is always situated internally. It consists of a large number of fragile bony plates with spaces between them called the cancelli. There are lacunæ and canalicula, but no Haversian canals, their place being taken by the cancelli. (In the bones of the cranium this tissue is called the diploe.)

Covering of Bone.

The external surface of every bone is covered by a tough, fibro-vascular membrane, the periosteum, excepting where tendons play over the bone, and its articular surfaces, upon which there is a layer of cartilage. The periosteum, firmly adhering to the bone, contains minute blood vessels which are thickly distributed before entering the osseous tissue, and it contains two layers, an outer one, fibrous and protective, and an inner one, which consists of fine connective tissue and contains bone-producing cells. The inner layer is continued into the Haversian canals, a layer of cells also existing between the canal wall and the contained vessel. It affords support and protection to the bone and attachment to tendons and ligaments which frequently become continuous with it. It varies in thickness, being dense and strong on bones nearest the skin and liable to injury. In the young animal it is thicker and more vascular than in the adult. Blood vessels which ramify in the periosteum pass directly to the bone. The external surface of a bone is always studded with numerous foramina through which these enter. The periosteum, owing to its inelasticity, is, when inflamed, the

seat of intense pain; and should any part of it be stripped off, there is every probability of the denuded bone dying and exfoliating. It is most vascular near the joints where it terminates by joining the articular cartilage, or passes to the next bone, but it never covers an articular surface. The internal, or medullary cavities, are lined by a more delicate vascular membrane, the endosteum or medullary membrane, which is prolonged into the cancelli and Haversian canals. It is very thin, consisting of delicate areolar tissue, filaments from which serve to support the marrow, the nutrient or medullary arteries entering the bone by the so-called nutrient foramina being chiefly distributed in it. The periosteum covering the bones of the cranial vault is called the pericranium.

Contents of Bone.

Marrow is a soft yellow fat, the cells of which are supported by areolar tissue, it is contained in the medullary canal and cancelli and thus fills up the cavities of the bone, containing many blood vessels. The large bones of most birds in adult life contain air instead of marrow, but in the bones of a mammal in perfect health there is considerable quantity of the latter which becomes diminished in diseases. In the bones of the fœtus there is little or no true fatty matter, but a transparent reddish fluid, the red marrow, is found, it consists of specific mycloid cells containing numerous nuclei.

Blood vessels are numerous in bone tissue, the arteries ramifying in the periosteum enter by the Haversian canals, the medullary artery enters by the nutrient foramen, and the arteries of the cancellated tissue pass through foramina situated near the articular surfaces. The veins are numerous and do not accompany the arteries, but occupy separate canals, the diplœ in the cranial bones contain large dilated veins. Lymphatics and nerves also exist in bone and its coverings.

Classes of Bone.

Bones are classed as long, flat and irregular. Long or cylindrical bones are found in the extremities where

they serve as levers and pillars of support. For description, a long bone is divided into a centre or shaft and extremities. The shaft is cylindrical and consists of a shell of compact tissue of varying thicknesses, which encloses the cancellated tissue and medullary canals, and is pierced by the medullary or nutrient foramen. It is smallest in the centre, expanding towards the extremities, and is circular, oval or prismoid in form. When a long bone is placed nearly vertically under the body, the internal wall of the shaft is usually the thickest; when obliquely placed the thick portions of the shaft correspond with the line through which the centre of gravity passes. Long bones are never straight, they may be twisted, as in the humerus, and if bent are generally convex on their exposed surfaces, the shell being thickest on the concave side. The extremities of long bones always exceed the shaft in circumference and are remarkable for their irregularity of outline, they are expanded and roughened to afford surface for the attachment of tendons and ligaments, their protuberances also materially increasing the mechanical power of muscles by serving as pulleys over which the tendons play. The extremities are composed of cancellated, with a thin layer of compact, tissue, the cancellated getting gradually less dense towards the centre of the shaft which is occupied by the medullary canal. While the extremities exceed the shaft in diameter their weight is not relatively greater, their increase in size being due to a diffusion and expansion of material, not to an addition of substance. This arrangement lightens and strengthens the bone besides filling its cavities with a fatty buffer to resist concussion. The hardest part of a bone is usually the thin portion lying next to the articular surface; it is only found when the bone is fully developed and it rests upon a series of arches formed by the cancelli; this thin layer is covered by cartilage. Excepting on their articulating surfaces, the extremities of long bones are copiously pierced by foramina, which chiefly transmit blood vessels to and from the interior.

Flat or tubular bones exist where mechanical action is at a minimum and help to enclose cavities containing important organs. Thus the cranium protects the brain,

the scapula and ribs protect the respiratory organs and the heart. Flat bones are composed of two thin expanded plates of compact tissue, rarely quite parallel to each other and enclosing a cancellated structure between them. The internal is considerably harder than the external plate, but not so thick and tough, the outer being more elastic and less liable to fracture. The connecting cancellated tissue is plentifully supplied with blood vessels. In the bones of the cranium the compact plates are called the tables and the spongy tissue between, the diplœ; the tables also in some facial bones may be widely separated with air cavities between them.

Irregular bones include all that are not classed with the foregoing. They are found in the vertebral column, in the skull, and also in the limbs. They usually possess many angles and indentations with surfaces for articulation and tendinous attachment, and consist of a fine, dense, external case of compact bone, enclosing cancellated tissue. In proportion to their size they present a much larger extent of articular surface and greater mechanical strength than any other class.

Surfaces of Bone.

No bone is strictly geometrical in form, although to a casual observer some may appear so. The chief irregularities consist of certain eminences and depressions, a knowledge of which is one of the chief requisites in the study of osteology. These are either articular or non-articular; the former being clothed with cartilage and assist in forming joints. Non-articular eminences are found on the external surfaces of most bones and receive the attachment of tendons and ligaments and they are frequently named from their real or supposed resemblance to some object. The term process may be generally applied to prominent elevations which are not necessarily non-articular. A spine is an elevation which tends to become pointed; a tubercle is a small, blunt elevation, which if more developed would be called a tuberosity, while the name trochanter is applied to the largest and most prominent of these. A crest, or ridge, implies a roughened line or border. Non-articular depressions passing completely or partly through a bone are called

foramen, canal, aqueduct or meatus, the first name being the most used. Blind cavities on the surface of a bone are called fossa. The terms notch and fissure indicate depressions or grooves which transmit various structures. When a depression leads to two or more foramina it is called an hiatus.

Articular Eminences. A caput, or head, is a more or less semi-spherical projection supported by a roughened and constricted cervix or neck. An ovoid convexity is called a condyle. Condyles are often found in pairs, the articular surfaces of which may be continuous or separated. A trochlea is an articular surface presenting a pulley-like appearance.

Articular Depressions. A glenoid cavity is shallow, and may be cup-like. When a cavity is deeper it is called cotyloid. The term facet is applied to articular surfaces large or small which are not well marked as either elevations or depressions.

Development of Bone.

Although the bones of the foal, calf, and young of other large quadrupeds possess greater solidity at birth than those of the human infant, yet they all pass through certain progressive stages of development before arriving at the degree of density which they ultimately possess. The tracing of future bone is recognized about the seventh week of fœtal development in local collections of soft granular gelatinous pulp which becomes gradually flooded with nucleated cells, held together by an opaque intercellular basis, or matrix, which with the cells equally distributed through it forms temporary cartilage, a material closely resembling ordinary gristle.

Bone is developed from temporary cartilage. The process of ossification begins at certain fixed points called ossific centres, and gradually spreads. In long bones there are three ossific centres, one in the centre of the shaft called the diaphysis and one at each extremity called the epiphysis. When any large process is superadded it possesses a distinct ossific centre called an apophysis. As ossification commences in the shaft; there are, for some time after birth, intervening portions

of unossified cartilage, marked by the deep ring in the long bones of young animals; they disappear at variable periods, the portions of bone hitherto imperfectly united becoming consolidated into one firm mass. The bone increases in length by the growth of the unossified ring, uniting the shaft and epiphysis, until the ring fills up, when growth is completed. Should an epiphysis unite with a diaphysis prematurely by acceleration of the process of ossification through disease, growth being thus arrested, the bone will be shorter than its fellow. The shaft of a long bone increases in circumference by deposits of new bone on its external surface derived from the inner layer of the periosteum (which has been termed the osteogenic membrane). In the periosteum there are two layers, an outer, strong and fibrous, and an inner, soft and containing osteoplastic cells which produce layers of new bone. In flat bones ossification usually radiates from a centre and is directed by the membrane investing each surface of the bone; some of them possess numerous apophyses.

Ossification is completed in some bones much earlier than in others, and at birth those which are required for support and progression are farthest advanced.

The bones of the cranial vault are developed from membrane (not from cartilage). In early fœtal life the brain is covered by two membranes closely united, viz.: the pericranium and dura-mater; between these, bones become developed from radiating ossific centres. This may be termed intramembranous as opposed to intracartilaginous ossification.

The Skeleton.

By the term skeleton is generally understood the bones of an animal held in their proper positions by ligaments or by wires or screws. The former is called a natural, and the latter an artificial skeleton. The majority of bones exist in pairs, but there are exceptions, as the vertebra, sternum and some of the bones of the head. Anatomists differ as to the number of bones in the skeleton, but for all practical purposes it answers to number them as 216, or including teeth 256.

In speaking of the anatomical position and relation of bones as to other structures, continual reference is made to imaginary lines or planes. With reference to quadrupeds imaginary planes are supposed to lie as follows:

A longitudinal median vertical plane descends through the centre of the head, vertebral chain and trunk, midway between the right and left extremities to the ground, dividing the body into two exact halves. Right and left vertical planes are placed parallel to the former, but external to the body. At right angles to these an anterior vertical plane is placed in front and a posterior one behind. A superior horizontal plane lies above the body between the anterior and posterior planes, while parallel with the superior is an inferior horizontal plane placed under the feet. The external surface of an organ or region is that which faces the lateral plane on the side where the organ is situated; the internal surface faces the median plane; the anterior surface the anterior plane, and the posterior surface the posterior plane. The superior and inferior surfaces are those facing their respective planes. This imaginary index may be applied to any particular region or part as well as to the whole body. Modifications of these terms are used when it is required to point out the precise situation of a structure. For example, take the anterior limb and suppose it encompassed by the planes as described. If we wish to describe the situation of any object on the upper part of the lateral region, the term supero-lateral would be used. If the object were on the lower lateral part, then we would say the infero-lateral, or to be more explicit we would say infero-external or infero-internal according to whether the object be on the external or internal part of the inferior region. Similar modifications are used in speaking of the anterior and posterior surfaces. Supero-anterior means the superior part of the anterior region, antero-superior an anterior part of the superior region. For description, structures (especially bones) are divided into two or more parts. Thus we allude to the superior, middle and inferior third of a part. The end of a structure which is nearest to the vertebral column is often termed the proximal end, while the end

furthest from the column is called the distal end. For the purpose of description the skeleton is usually divided into head, trunk and extremities. The trunk consists of the vertebral column, ribs and sternum.

Vertebral Column—(Lt. Verto to turn).

The vertebral or spinal column may be considered the foundation of the skeleton from which all other parts proceed. It extends the whole length of the body and consists of a series of single bones termed vertebræ and is divided into five regions, viz.: the cervical 7, dorsal 18, lumbar 6, sacral 5, and coccygeal 13 to 20, respectively the regions of the neck, back, loins, croup and tail. While all possess certain points of confirmation in common, special peculiarities distinguish the vertebræ of any one region from that of another. Vertebræ are either true or false. True vertebræ possess certain typical parts and they never, in health, unite by ossification, while false vertebræ either do not possess the essential characters of true, or they may so unite.

True Vertebrae.

A true vertebra consists of a body, arch, notches; spinous, transverse and articular processes. The body is the solid block of bone on which all the other parts are built, and it is situated below the spinal canal, its anterior surface is convex and its posterior concave. The upper surface is flat or slightly concave, its inferior surface convex and sometimes terminating in a spinous process. The arch rises from the supero-lateral surfaces of the body by two processes of bone termed pedicles, from each of which a plate of bone, the lamina, expands and passes inwards, their union in the median line completing the arch which encloses the neural canal or spinal foramen.

The notches are four in number, two anterior and two posterior, so placed that those of the anterior surface of one vertebra correspond with those of the posterior surface of another, thus forming a large opening, the intervertebral foramen, which gives passage to the spinal nerves and blood vessels.

Each true vertebra except the first two cervical ones has four /oblique or articular processes (zygapophysis)

on the superior and lateral parts of the arch. The faces of the anterior of these processes are directed upwards and inwards; those of the posterior downwards and outwards. They articulate and form joints with processes of contiguous vertebræ.

The transverse processes (diapophysis) on each side spring from the sides of the body and pedicle and vary in size and shape in different regions. The spinous processes are superior and inferior; the superior being larger and of different size in different regions; the inferior are rudimentary except in the cervical region.

The bodies of the vertebræ placed in natural apposition thus form a central bony column, to which the arches and processes are attached. The arches, with their connecting ligaments, form superiorly a cavity, the spinal or neural canal, which extends from the head to the tail and contains the spinal cord with its membranes and blood vessels. The articular processes strengthen the connections, while the spinous and transverse processes are levers to which muscles are attached, their development having great influence on the physical conformation and capabilities of the animal. The ribs may be considered as continuations of the dorsal transverse processes. They form the inferior or hæmal arch of their own region.

False Vertebrae.

The false vertebræ are found in the sacrum, which consists of vertebral segments united by the ossification of their connecting material; and in the coccyx, the skeleton of which consists of rudimentary or imperfectly developed vertebræ. The sacral segments in the early stages of life are separable and present all the characteristics of true vertebræ.

Cervical Vertebrae.

General Features. There are seven cervical vertebræ in nearly all mammalia. They are numbered in order from the head; the first is called the atlas and the second the axis or vertebræ dentata; these, with the 6th and 7th, differ from the rest, which are essentially alike.

The bodies of the cervical vertebræ are larger and longer than those of any other true vertebræ, are quad-

rangular in shape. The anterior surface or head is convex and somewhat heart shaped with the apex downwards, while the posterior surface presents a corresponding cavity. The superior surface is flattened, and presents, close to the pedicle on each side, a distinct furrow which contains the spinal vein ; these lateral furrows are united by a transverse furrow and partly covered by a thin, bony plate. The inferior surface possesses a spinous process which increases in size from before backwards, terminating in a tuberosity. The lateral surfaces of the body above the inferior spine are flattened and somewhat excavated. The superior spinous processes or neural spines are mostly rudimentary and are bifid posteriorly. The transverse processes are broad, short, strong and irregular in shape, pass directly outwards, and divide into two parts. All of them except the 7th are pierced by the vertebral foramen for the passage of the vertebral artery and vein. The articular processes, larger than in any other region, have flattened, oval articular surfaces, the anterior two looking upwards and inwards, the posterior downwards and outwards.

The 1st, 2nd, 6th and 7th, having peculiar confirmation, require special notice.

The *Atlas* (as the first is called) because in human anatomy it supports the head—in quadrupeds the head is supported from it—presents no well defined body, but consists of a strong ridge of bone, the superior surface convex with a slight longitudinal elevation in the median line from which the wings slope downwards and backwards. The wings are large, flat transverse processes wider than those of any other true vertebra, each is pierced superiorly by three foramina, two anteriorly and one posteriorly. The anterior surface presents two notches and two large concave articular facets for articulation with the condyles of the occipital bone. The posterior surface is excavated on its inferior margin to receive the odontoid process of the axis, and on each side is a broad, slightly convex articular surface. The atlas is the only vertebra possessing none but true joints.

The *Axis* or vertebra dentata possesses a larger body than any other true vertebra and anteriorly presents a peculiar projection called the odontoid process which

fits into the ring of the atlas and around which the head and atlas rotate. The superior spine is nearly as long as the body, is convex, and consists of two lateral halves united anteriorly. The inferior spine is sharp and well developed. The transverse processes are the smallest in the cervical region and single and are pierced by small foramina. The spinal canal is narrow and instead of notches there are two foramina anteriorly. In the horse the atlas and axis do not articulate above the canal, and there is considerable space between them—the atlo-axoid space—which is covered by soft structures only. Here the operation of pithing can be performed.

The Two Last Segments.

The *sixth* cervical vertebra has a much shorter body than those anterior to it and has no inferior spine. The transverse processes consist of three lateral divisions, and the foramina, notches and canal are of great size.

The *seventh* is the shortest of all, is very strong, with elevated neural spine pointed upwards and forwards, but scarcely any inferior spine. Its transverse processes are small and have usually no vertebral foramina, while the notches and canal are large; on each side of the body posteriorly it presents a depression for articulation with the first rib. It closely resembles the first dorsal vertebra.

Dorsal Vertebrae.

The dorsal vertebræ are eighteen in number (rarely nineteen), always correspond in number to the pairs of ribs, and in the horse form the weight-bearing portion of the column, extending over the whole length of the chest. Their bodies, the smallest of the true vertebræ, are short and thick and somewhat semicircular, each presenting a middle ridge along its under surface. The anterior surface convex and the posterior concave. The transverse processes are small, and each presents a facet postero-inferiorly for articulation with the tubercle of the next anterior rib. The superior spines are larger than in any other region, and vary in size, shape and direction; the first twelve are directed backwards, the next three nearly upright, and the last three forward; the length increases to the fifth and then decreases to the fourteenth, which is generally shorter than those behind it. The

articular processes, arch and neural canal are small. An ordinary dorsal vertebra has twelve articular surfaces, viz., three anterior, three posterior and three on each side; of the latter, two are for the heads of two ribs and the third for the tubercle of the anterior rib. The eighteenth segment being attached to but one rib on each side, has but eight articular surfaces. The first thirteen form the skeleton of the withers, and, when well developed, the height of their spines increases the surface for muscular attachment and also affords greater leverage.

Lumbar Vertebrae.

These form the skeleton of the loins, and are shorter in the horse in proportion to his size than in any other animal. Their number is usually six, sometimes five. Their bodies are thick and strong, the anterior surfaces are more convex and their posterior more concave than in the dorsal region. The arches enclose a large canal, and have, with one or two exceptions, both anterior and posterior notches, the neural spines are strong, broad, and flattened laterally, and have sharp anterior and posterior edges with roughened expanded extremities. The transverse processes are longer than in any other region, extend nearly horizontally to the bodies, and are broad and flat with rounded extremities, the last two articulate with each other and sometimes in old age unite by ossification; the last articulates in a similar manner with the sacrum. The first four have six articular surfaces, the fifth eight, and the sixth ten.

False Vertebrae.

The *Sacrum.*--The bone of the croup is a single, somewhat triangular bone consisting of five false vertebræ united in the young animal by articulation; in the adult by ossification. It contains the continuation of the spinal canal, forms the roof of the pelvis, and has articular surfaces by which the pelvic arches are attached. (Its direction varies somewhat according to the breeding of the animal. In well-bred animals its long axis is placed in a nearly horizontal line, while in coarser-bred animals it often declines from before backwards, giving a drooping appearance to the croup.) It presents for consideration superior or inferior surfaces, two lateral borders and

anterior and posterior extremities. The superior surface is irregularly convex, with flat-topped spines decreasing in height but increasing in breadth as they extend backwards. The inferior surface is smooth and rather concave, and crossing the bone transversely are four slightly elevated lines, making the connections between the segments. Between these lines are four large foramina, and at the anterior end two notches.

The *anterior* extremity is almost entirely articular. The posterior extremity presents the diminished spinal canal in its centre, and below the flat surface which articulates with the first bone of the coccyx, and above the last spinous process while the notches are on each side. The *lateral borders*, anteriorly, are roughened for the attachment to the iliac bones under which they lie. Posteriorly, they are roughened for the attachment of the sacro sciatic ligaments, and terminate in small transverse processes. The sacrum has five articular surfaces on its base, one on each side and one on its apex.

The Coccyx.

The coccygeal are false vertebræ varying in number from thirteen to twenty, are very rudimentary in form, are oblong, mostly constricted in the centre and expanded where they articulate with each other. The four or five anterior ones are slightly flattened above, and generally possess incomplete arches and processes; the remaining segments merely consist of bodies which diminish in size posteriorly. There is no complete neural canal the first two or three sometimes have their neural arches complete.

The Thorax.

The dorsal vertebræ superiorly, the ribs and their cartilages laterally, and the breast bone inferiorly, form the skeleton of a large cavity called the Thorax or thoracic cavity.

The Ribs.

In the horse the ribs usually number eighteen on each side. They extend in a series of arches of varying curvature from the dorsal vertebræ above towards the

sternum and sides of the abdomen below. Their shape, in a great measure, determines the conformation of the thorax; they protect its contents and aid in its contraction and expansion. To the distal end of each rib an elongated piece of cartilage (the costal cartilage) is attached, and eight of these connect the eight anterior, called sternal or true ribs, with the sternum. The ten posterior ribs, having only an indirect sternal attachment, are known as asternal or false ribs. The ribs pass first outwards and backwards, and then in an arched direction downwards, their cartilages inclining inwards and forwards. They gradually lengthen from the first to the ninth, then progressively shorten. Their curvature increases from the first, which is nearly straight, to the last, which forms a large segment of a comparatively small circle. The greatest breadth is attained in the 5th, 6th, 7th and 8th, which in their middle portion exhibit the more especial characters of flat bones. Each rib presents for consideration superior and inferior extremities, and a shaft or body having anterior and posterior borders and external and internal surfaces. The superior or proximal extremity consists of a head, a neck and a tubercule. The head presents two articular convex surfaces, one directed forwards and inwards and the other backwards and inwards, and articulate with the vertebra. The neck is the constricted portion supporting the head. The tubercle is a prominent eminence at the posterior part of the neck; it has a flat facet which articulates posteriorly with the transverse process of a vertebra. External to the tubercle is an eminence, the angle, where the rib is suddenly bent downwards. The inferior or distal extremity is expanded and joined firmly to its cartilage. The anterior border is rough and excavated along its upper third to give attachment to the intercostal muscles. The posterior border is grooved along its upper third for the intercostal muscles, nerves and blood vessels. The external surface is convex in every direction; between the head and the angle it is roughened for muscular attachment. The internal surface is concave from above downwards and convex from side to side, and is smooth, and mostly covered by pleura. With the exception of the last, and sometimes the last two, each rib has its cartilage. Those attached to the sternum are smallest at their

proximal ends, becoming expanded before attachment to the sternum, while those of the false ribs are largest at the proximal ends, tapering to points below, pass downwards and forwards, overlapping each other. Each true rib has four articular surfaces, two on the head, one on the tubercle and one at the distal end.

Sternum.

The sternum, or breast bone, is placed in the inferior longitudinal line of the body at the antero-inferior part of the thorax. The anterior portion somewhat resembles the keel and cut-water of a boat; it is elongated and concave above, convex below, with its anterior part flattened laterally and its posterior part flattened above and below. It is constructed of six or seven irregularly formed segments or sternebræ, united by cartilage in the young and by partial ossification in the adult animal (complete ossification seldom or never takes place in this bone). Its anterior end is surmounted by the cariniform cartilage and its posterior extremity prolonged by the ensiform or xiphoid cartilage. The superior surface is triangular and concave, the inferior surface is narrow and convex anteriorly, the centre presents a prominent ridge coated with cartilage. The sides are flat and irregular and present between the segments depressions for articulation with the costal cartilages.

The cariniform cartilage presents a convex border looking forwards and upwards; latterly it is flattened, and its inferior border, prolonged over the first segments of the sternum, ends in the cartilaginous ridge. The ensiform cartilage is somewhat heart-shaped, the apex being directed downwards and backwards. Its superior surface is broad and cup-shaped, its inferior surface is convex.

The bony framework of the thoracic cavity bears some resemblance to a truncated cone with its apex or anterior extremity compressed laterally. The anterior aperture is a triangular space, with its apex directed downwards and slightly forwards, formed by the sternum, the first pair of ribs and the first dorsal vertebra; it gives passage to the œsophagus, trachea, nerves and blood vessels. The base or posterior aperture is oval

and slopes obliquely downwards and forwards from the vertebræ; it is formed by the last dorsal vertebra, the last pair of ribs, the cartilages of the false ribs and the ensiform cartilage. Its boundaries give attachment to the diaphragm, a large muscular curtain which divides the thorax from the abdomen.

The Skull.

General View. The skull articulates with the atlas from which it is suspended. Its position varies with the attitude of the animal, but in our descriptions we shall always suppose it to be placed in a horizontal position. In the young animal it is composed of a number of bones, all of which, with the exception of the lower jaw, the teeth, the bones of the tongue and ossicles of the ear unite by ossification in the adult. Excluding the teeth and the internal bones of the ear there are 36 bones in the skull, 6 single, the rest in pairs.

The skull is divisible into two parts, the cranium and the face. The former is a cavity situated in the supero-posterior region of the skull and continuous with the spinal canal, it contains the brain and its appendages and in the horse is comparatively small, occupying about one-fifth of the skull. The remaining bones form the face. In early life the bones of the head are united by sutures, or interposed layers of fibrous tissue, and after union by ossification a line usually indicates the position of the late suture. One of the principal sutures is the longitudinal which extends in the median line from the poll to the nasal peak, and marks the division of the skull into two lateral halves.

In describing the skull we will suppose it placed in a horizontal position resting on the lower jaw and divided into superior, inferior, lateral, anterior and posterior regions.

The superior region is a surface formed by three pairs of bones, the parietal, frontal, and nasal, each bone being joined to its fellow by a part of the longitudinal suture. The parietal bones are the hindermost of the three, are convex, and form part of the roof of the cranium or brain cavity, the frontal pair are flatter and very broad above the level of the orbits, the region of the fore-

head. The nasal bones together form a semi-cylinder, and gradually diminish in breadth anteriorly, forming the nasal beak. The prominent transverse ridge bounding this region posteriorly is the occipital crest.

The inferior region presents a very irregular surface, bounded below by the inferior maxilla or lower jaw, a bone whose two segments are firmly united anteriorly, but diverge backwards in the form of a letter " V," each terminating superiorly in a convex articular surface, the maxillary condyle, before which is the prominent coronoid process, the lever of the lower jaw. The diverging parts or rami of the jaw include a space called the maxillary space. We find in the anterior portion the inferior incisor teeth, and in the male the canine teeth, and in the rami the inferior molars, the space between the molars and incisors is called the interdental space and is always large in herbivorous animals. If we remove the inferior maxilla we notice the following objects: Anteriorly, the premaxilla, bearing the upper incisors and partly the canine teeth, and just behind the incisors, in the median line, a small round aperture, the foramen incisivum, while the interdental space and molar teeth are similar to those in the lower jaw. The flattened surface extending from the incisors backwards between the molars is the bony palate, formed chiefly by the superior maxilla, and bounded posteriorly by the palatine arch, which is semi-eliptical in form and marks the entrance to a large cavity above called the nasal chamber; this cavity is, in the fresh state, divided into right and left compartments by a cartilagenous septum, the septum nasi.

Between the posterior molars and the palatine arch are the two palatine foramina; behind, and bounded by the palatine arch, are the entrances to the nasal chamber, right and left, called the posterior nares, and the slender median bone stretching from behind forward in the cavity is the vomer, which indicates the division of chamber into right and left fossæ. Continuous with the vomer we find an irregular column of bone reaching to the back of the skull; this column consists of three pieces, the presphenoid anteriorly, then the basi-sphenoid and lastly the basi-occipital. On the posterior edges of the

palatine arch are two small sharp projections, the ends of the pterygoid bones, and behind them the rough palatine ridges, the posterior edges of which are formed by the pterygoid processes of the sphenoid bone; outside the base of each of these processes we have the posterior aperture of the subsphenoidal foramen. Just behind the last molar teeth are two large prominences, the alveolar tuberosities, between which and the palatine ridges and pterygoid bones are the smooth staphyline grooves. Outside the palatine ridges are two large spaces, the orbito-temporal cavities, each of which is bounded externally by the zygomatic arch, anteriorly by the alveolar tuberosity, posteriorly by the articular surface of the squamosal bone, with which the inferior maxilla articulates, and internally by the sphenoid and palatine bones. Each cavity opens by two large apertures on the lateral aspect of the skull, the posterior portion is called the temporal and the anterior the orbital fossa.

The articular surface of the squamosal bone terminates posteriorly in a projection called the anterior mastoid process, behind and internal to which is an irregularly shaped bone, the petrosal, which contains the internal mechanism of the ear and gives attachment to the bones of the tongue (the os hyoides). Between the petrosal and the basi occipital we have a large aperture leading into the cranial cavity, the foramen lacerum basis cranii. Posterior to the petrosal bones are seen two large processes pointing downwards, the styloid processes of the occipital bone, (these must be distinguished from the small petrosal bones.) Still further back we have the occipital condyles by which the head articulates with the atlas.

The *lateral surfaces* exhibit inferiorly the external surface of the rami of the lower jaw, and antero-superiorly a triangular space, formed chiefly by the superior maxilla, more or less convex but sometimes hollowed in old animals, and presenting the infra-orbital foramen in its centre. The zygomatic arch presents externally a well marked ridge or line, which is continued anteriorly by a ridge called the maxillary spine. A process thrown outwards and downwards by the frontal bone articulates with the zygomatic arch about its

middle; it is called the frontal or external orbital arch, and it indicates the division of the cavity within into orbital and temporal fossæ. The orbital fossa is a conical cavity, deep in which anteriorly is a depression, the maxillary hiatus, which leads to the palatine, spheno-palatine and superior dental foramina, and posteriorly another depression, the orbital hiatus, containing the optic, pathetic, lacerated and round foramina. This cavity contains the eye and muscles by which it is moved the lachrymal gland and all accessories to the organ, together with a large portion of adipose tissue or fat.

The temporal fossa is incompletely separated from the orbital by the orbital arch. It is oval and lodges the temporal muscle and the lever process of the lower jaw, and contains many foramina.

The *posterior part or base* of the skull presents superiorly the occipital crest continued downwards by the sharp mastoid ridges. Below the crest is a broad surface, and below that in the median line is the neural canal of the occipital bone, called the foramen magnum, bounded laterally by the condyles which are flanked by the styloid processes.

The anterior part or apex, formed by the premaxilla and body of the inferior maxilla, contains the incisor teeth and is more or less rounded in profile according to the age of the animal. In front it is surmounted by the external opening of the nasal cavities. This opening, included between the premaxilla and the nasal spine, is divided, in the fresh subject into two orifices, the anterior nares.

Cavities in the Skull.

The skull contains internally the cranial cavity, the nassal fossæ or chambers, and the sinuses, which are appendages to the latter.

Cranium.

The cranium is an irregular oval cavity, the walls of which are formed by the frontal, parietal, occipital temporal, sphenoid and ethmoid bones. It occupies about one-fifth of the skull and contains the brain and its appendages.

Nasal Fossae.

The nasal fossæ are two cavities separated in the fresh subject by a cartilaginous septum, the septum nasi, which extends from the ethmoid bone to the anterior nares. The framework of these fossæ is formed by the nasal, the superior maxilla, the frontal and the palative bones, the whole forming an irregular tube bounded posteriorly by the ethmoid bone, two turbinated bones being situated in each fossa. The vomer in the median line gives attachment below to the septum nasi.

Sinuses.

These are widening cavities in the bones of the face, They communicate freely with each other and with the nasal fossæ of which they may be regarded as prolongations. Usually they number four on each side, viz.: the frontal, maxillary, sphenoidal and ethmoidal.

The *frontal* sinus is situated inside the inner plate of the orbital fossæ. It communicates with the maxillary sinus below by a large opening through the bony partition between them; a thick vertical plate, always imperforate, separates this sinus from its fellow.

The *maxillary* sinus situated below and before the orbit is the largest of the sinuses; a ridge which contains the superior dental canal divides it into two compartments.

The *sphenoidal* sinus is a small irregular cavity formed by the sphenoid, ethmoid and palatine bones.

The *ethmoidal* sinus, the smallest of all, is a space in the ethmoid bone.

The sinuses contain air, and are larger in the adult than in the young animal, are partially divided by imperfect septa, which run across their interior. In the fresh state they are lined by mucous membrane.

"The division of the skeleton includes the bones which belong to the limbs or extremities and those which help to join the latter to the trunk. The horse, like the majority of mammals, has two pair of legs, an anterior, fore, thoracic or pectoral, and a posterior hind or pelvic pair, which have bones of connection, called respectively the pectoral and pelvic arches. In

the horse as in many other animals, there is no articular connection between the anterior limb and the trunk, hence the pectoral arch is incomplete. The actual attachment of this limb is entirely muscular, the body being suspended, as it were, in a muscular sling between the fore limbs."

The Bones of the Fore Extremity.

The bones we have to describe in the fore extremity are the scapula, humerus, radius and ulna; the carpus, consisting of eight bones, viz.: from within outwards, the scaphoid, lunar, cuneiform, and the trapezium behind the latter, in the upper row; and the trapezoid, magnum, unciform, and the pisiform behind the trapezoid in the lower row, three metacarpal bones, two of which are imperfect; three sesamoid bones, one pair and a single one, the latter called the naviculare bone, and finally, three phalanges or finger bones, viz.: the os suffraginis, os coronæ and os pedis.

Scapula.

The scapula is a flat bone situated on the antero-lateral surface of the thorax with its long axis sloping downwards and forwards. It is triangular with the base turned upwards. (In the horse this bone is small but strong, it is broad and thin superiorly, becoming narrow and thicker inferiorly. Its slope is a point of importance in the conformation of an animal, and varies to some extent, but its inferior angle is situated about the level of the first rib, the posterior angle being usually at or near the level of the 6th or 7th.)

It offers for consideration 2 surfaces, 3 borders and 3 angles.

The external or dorsum surface is divided into two unequal parts by a crest called the spine running nearly the whole length, and has a tubercle at its broadest part. (The clavicle, in animals that possess one, is attached to the inferior extremity of the spine.) The hollow part in front of the spine, the antea spinatus fossa receives a muscle of the same name. The postea spinatus fossa (behind the spine) is larger, and receives the postea spinatus muscle. The nutrient foramen is in this fossa.

The *internal* or ventor surface is smooth and uneven, its fossa, the subscapularis, lodges the subscapularis muscle.

The *superior* border is nearly straight and has the cartilage of prolongation attached to it.

The *anterior* border superiorly is convex and sharp, inferiorly concave and blunt, terminates in the coracoid apophysis for muscular attachment.

The *posterior* border is blunt and rough.

The anterior angle is thin, the posterior thick. The inferior expanded, and separated from the rest of the bone by a neck, and contains an articular depression, the glenoid cavity, articulating with the humerus, and surmounted by a roughened ridge for insertion of the capsular ligament.

Humerus.

The humerus is a long bone extending obliquely downwards and backwards from the scapula to the radius. It possesses a shaft and two extremities.

The *shaft* is twisted, with 4 surfaces. The anterior surface is somewhat triangular with the apex downwards. The posterior is round and smooth and terminates inferiorly in two prominent ridges, the epitrochlea and epicondyle. The external surface contains the musculo spiral groove which winds obliquely downwards and forwards and is separated from the anterior surface by the deltoid ridge, which extends from the proximal end to the coronoid fossa. A rounded prominence, the external tuberosity, is seen on the upper part of this ridge bending backwards over the spiral groove. The internal surface has no distinct separation from the anterior and posterior surfaces; it has a prominence, the internal tuberosity, about its middle third.

The *proximal* end presents the head and the trochanters. The head is convex, and larger than the glenoid cavity with which it articulates, allowing extensive and varied motion; it is surrounded by a roughened border for insertion of the capsular ligament, below which is the constricted neck of the bone.

The *external trochanter* has two prominences, the anterior or summit of the trochanter, which forms the external

boundary of the bicipital groove gives insertion to the outer tendon of the antea spinatus muscle, while the posterior, the more prominent of the two, is covered by fibro cartilage over which glides the tendon of the postea spinatus, which is inserted to a rough surface below.

The *internal trochanter* is divided into three parts, anterior, posterior and inferior ; the anterior forms the internal boundary of the bicipital groove, which is divided by a middle prominence into two channels which are covered with fibro cartilage and serve as a pulley over which the tendon of the flexor brachi muscle plays.

The *distal extremity* is smaller and smooth to articulate with the radius and ulna, its surface is convex, and wider in front than behind. A groove, terminating in the olecranon fossa posteriorly, divides it into an internal and external condyle or trochlea, the latter being the smaller.

The Forearm.

The bones of the forearm are the radius and ulna, which in young animals are distinct, but in the adult become united by ossification, and are sometimes described as one bone, the os antibrachii. We will describe them separately.

Radius,

The radius is a long bone placed vertically between the humerus and the carpus. The shaft is flattened and curved with gradually expanding extremities. Its anterior surface is smooth, its posterior concave from above downwards, and presents, towards its external border, a rough triangular surface, to which the ulna is attached by interosseous ligaments in the young, and by ossification in the adult animal. The shallow, transverse groove above this surface assists in forming the radio ulnar arch, and the nutrient foramen is near this groove. The external and internal lateral surfaces are round and have no distinct separation from the anterior and posterior surfaces.

The *proximal extremity* is widest from side to side, and presents an articular surface divided into two depressions, the glenoid cavities, which receive the condyles of the humerus ; the inner is the larger, the

outer has a slight eminence in its centre. A rough ridge around the surface gives attachment to the capsular ligament, the anterior part has a prominent lip, the corocoid process, in its centre, and near the internal border the bicipital tuberosity. On each side of the articular surface is a rough portion for the lateral ligaments, the external of which is called the external tuberosity. Posteriorly, two facets articulate with the ulna.

The *distal extremity* is also widest from side to side, its articular surface is divided into three facets; the internal, the largest, articulates with the scaphoid bone, the middle with the lunar, the external, the smallest, with the cuneiform and trapezium. The whole is surrounded by a ridge for the capsular ligament. The anterior part has two deep vertical grooves and a shallow oblique one, laterally two processes, the internal the larger, for attachment of the lateral ligaments.

Ulna.

The *ulna* is an irregular bone, triangular in form with the base uppermost. It grows but little after birth. It possesses a body and two extremities. The body is triangular and has three surfaces and three borders. The anterior surface corresponds to the posterior surface of the radius to which it is attached, having superiorly two convex facets to articulate with the radius; below this is a rough portion for the attachment of the interosseous ligaments, and still lower a transverse groove which assists in forming the radio-ulnar arch. The external surface is flattened, the lateral borders are thin, the posterior border concave and round, the distal extremity is pointed and extends a little below the middle of the radius.

The *proximal extremity* corresponds to the elbow of man; it projects upwards and backwards from the articular surface of the radius, and is called the olecranon process. It presents two surfaces, two borders and a summit. The external surface is slightly convex and rough, and internal surface is hollow and smooth, the posterior border concave, thin and smooth; the anterior border—thin superiorly—is hollowed into a crescent-shaped surface, which articulates with, or rather behind and between, the condyles of the humerus; the pro-

minent portion is known as the beak of the olecranon. The summit is the broad, rough protuberance which gives insertion to the tendon of the triceps extensor brachi muscle, the olecranon being the lever on which that muscle acts. (It is important to note that the development of the ulna is directly proportional to the number of fingers or digits, hence the horse, being a monodactyle, has a very short ulna. While in the ox and dog it is much longer.)

Carpus.

The knee, or carpus, corresponds to the wrist in man. There are seven bones in the knee, and occasionally an eighth is found, which is very small, and called the pisiform; with this the knee consists of eight bones, names and arranged as follows in two rows:—

The scaphoid occupies the inner side of the upper layer, the lunar the centre, and the cuneiform the outer side. The trapezoid the inner, the magnum the centre, and the unciform the outer side of the lower row. The trapezium is situated behind and articulates with the cuneiform; consequently, it occupies the outer side of the knee, and the pisiform is found behind the trapezoid. These bones are all somewhat similar in character; they are irregular in shape, and possess small facets to articulate with each other and with other bones. The upper row forms an articular surface adapted to that of the lower extremity of the radius, the inferior surface of the upper row presents a slight concavity for articulation with the superior surface of the lower row. The under surface of the lower row is nearly flat and articulates with the metacarpal bones. The true carpal joint or principal seat of motion is between the radius and the upper row; there is less motion betweeeen the rows, and still less between the lower row and the metacarpus. (The lesion, termed broken knees, usually occurs where there is the most extensive motion.)

Metacarpus.

The metacarpus is that part of the skeleton which lies between the carpus and the finger, consisting in the horse of three bones, one large one and two small ones, called splint bones.

Os Metacarpi Magnum.

The large metacarpal, or canon bone, is a long, straight bone, placed in a vertical direction, having a flattened shaft ; the anterior surface is convex and smooth, and the posterior broad, flat and pierced at about the upper third by the nutrient foramen ; on each side of this surface is a vertical ridge to which the splint bones are attached.

The *proximal end* presents a smooth articular surface formed by three facets corresponding to the lower surface of the lower row of the carpus ; on the intero-anterior portion of the head is a prominence for the insertion of the extensor metacarpi magnus tendon. On the posterior part is a rough surface from which the suspensory and cheek ligaments originate, and on each side two facets to articulate with the splint bones.

The *distal end* is formed by two condyles, convex from before backwards to articulate with the os suffraginis below and the sesamoid bones behind ; each condyle presents a depression on its side for attachment of the lateral ligament.

Os Metacarpi Parva.

The small metacarpal, or splint bones are tuberous above, and taper to a point below, reaching about $\frac{2}{3}$ down the large bone. The superior surface of each bone articulates with the carpus ; the inner one has two facets, and the external one but one ; below the articular surfaces externally the heads are rough. The internal lateral parts of the heads each present two articular facets to articulate with the large metacarpal. The anterior surface is flat and attached to the posterior surface of the large bones, one on each side, by ligaments in young animals and sometimes by ossification in the old. The bones gradually taper to a point or apex which terminates in a small knob. (These knobs are very prominent in well-bred animals and are sometimes mistaken for splints, which are exostosises between the large and small bones.)

Digit.

The digit or finger is composed of three bones placed one immediately below the other and having three

sesamoid bones behind. The joint which the large metacarpal forms with the os suffraginis and its two sesamoid bones is the fetlock joint, that between the os suffraginis and os coronæ is the pastern joint, and that between the os coronæ and the os pedis with its sesamoid or navicular bone is the coffin joint, or navicular joint.

Os Suffraginis.

The *Os Suffraginis* is a long bone with its shaft slightly flattened from before backwards, the anterior surface convex and smooth, and the posterior somewhat flat, presenting two rough ridges, triangular in form with the base upwards.

The *proximal end* presents a semi-lunar shaped articular surface consisting of two glenoid cavities for articulation with the condyles of the canon bone and a deep groove for the eminence between them, behind, on each side is a tuberosity—for ligamentous attachment.

The *distal end* presents two condyles divided by a groove; on each side is a depression for the attachment of the lateral ligaments.

Great Sesamoid Bones.

These bones, two in number, are placed side by side at the back of the fetlock; they are irregular in shape with smooth and concave anterior surfaces with the internal edges bevelled to articulate with the ridge of the metacarpal bone. The posterior surfaces, when in situation, form a channel which is covered with fibro cartilage for the passage of the flexor tendons. The apex and lateral borders are rough, and form a groove for the reception of the suspensory ligament. The base is also rough for ligamentous attachment.

Os Coronae.

The os coronæ is an irregular bone, with no medullary canal. The superior surface is smooth, and divided by an eminence into two glenoid cavities for the condules of the os suffraginis. The inferior surface is smooth and convex, and divided by a depression into two condyles which articulate with the os pedis and os navicular. The anterior surface is convex and very rough. The posterior surface is slightly excavated and not very rough,

and has on its upper part an eminence covered by fibro cartilage over which plays the tendon of the flexor pedis perforans.

Os Pedis.

The os pedis is an irregular bone situated within the hoof. It is semi-lunar in form, with the convexity in front. It is a very hard but porous bone, having many excavations and foramina for the transmission of arteries and veins. In this bone we notice the wall, the sole, the tendinous surface, the articular surface and the alæ or wings.

The wall, or anterior surface, is the semi-circular part in front and presents numerous depressions and foramina. Anteriorly it is surmounted by the pyramidal process which gives insertion to the extensor pedis tendon, in a depression on each side of which a ligament is inserted. The inferior edge of the wall is serrated and notched. At each side is the preplantar groove which ends posteriorly in a foramen of the same name. The sole or inferior surface is slightly excavated and rather smooth. The tendinous surface is the rough portion behind the sole. It presents a triangular, rough depression on its middle and anterior part, where the tendon of the flexor pedis perforans is inserted, and on each side the plantar groove, which terminates in the plantar foramen; the posterior part of this surface is rough. The articular surface presents two glenoid cavities separated by a slight eminence which terminates in the pyramidal process: this surface articulates with the os coronæ. Behind the cavities, a flat, narrow, triangular surface articulates with the os navicular.

The *alæ* or wings are irregular protuberances on the posterior part of the wall; they are bifid, being divided by a notch, the preplantar fissure, which in old animals is converted into a foramen. The inferior and posterior portion of the ala is the retrossal process, and the superior portion the basilar process.

Os Navicular.

The navicular is an irregular bone situated with its long axis transversely behind and below the os coronæ and behind the os pedis, with both of which it articulates

forming the so-called coffin joint. The superior surface is smooth, with two concavities and a central eminence. The inferior surface is rather rough and has also two concavities and a central eminence covered with fibro cartilage which forms a pulley over which plays the tendon of the flexor perforans. The anterior border is divided into two portions, a superior, smooth and triangular which articulates with the os pedis, and an inferior elongated, rough and porous. The posterior border is triangular, rough and porous. The extremities are pointed and attached to the alæ of the os pedis by lateral ligaments.

Joints of the Fore Extremity.

Shoulder joint.—Formed by the head of the humerus articulating with the glenoid cavity of the scapula.

Elbow joint.—Formed by the distal end of the humerus articulating with the proximal end of the radius and the ulna.

Knee joint.—Formed by the distal end of the radius articulating with the upper row of carpal bones which articulate with the lower row which articulate with the proximal ends of the large and two small metacarpals.

Fetlock joint.—Formed by the distal end of the large metacarpal articulating with the proximal end of the os suffraginis, with the two great sesamoid bones behind.

Pastern joint.—Formed by the distal end of the os suffraginis articulating with the proximal end of the os coronæ.

Coffin or Navicular joint.—Formed by the distal end of the os coronæ articulating with the articular surface of the os pedis, with the navicular or coffin bone behind.

Pelvic Arch.

The posterior extremity is united to the trunk by the direct articulation of the pelvic arch with the femur and sacral verterbra. The three bones which form the arch unite early by ossification and the entire arch is called the os innominatum. The two ossa innominata articulate with each other in the inferior median line, and at a later period this union also becomes ossified ; the complete structure is called the pelvis, and the space which it

helps to enclose is the pelvic cavity, which is the incomplete basin composed of the sacrum, part of the coccyx and the two ossa innominata, each of which is composed of three bones, viz.: the Ilium, Ischium and Pubis, which all meet in the acetabulum, or articular cavity for the femur.

Ilium.

The ilium is a flat bone situated partly upon the sacrum which with it articulates; it is irregularly triangular in shape, its extreme outer angle being one of the most prominent points of the animal, forming the point of the hip. It presents for consideration two surfaces, three borders, and three angles or processes.

The *external* surface is concave at its upper part, becoming convex and narrow further down, forming the upper part of the shaft of the ilium; as it approaches the acetabulum the shaft again slightly expands. This surface terminates in an obtuse angle, the outer side of which forms the anterior margin of the acetabulum; and the inner side, surmounting this cavity, marks the line of junction between the ilium and the ischium.

The *internal* surface is slightly convex, its upper portion consists of two parts, an outer smooth one, and an inner rough one which rests on the sacrum; on the lower portion is a line continuous with the brim of the pubis. Together these form the ileo pectineal line.

The *anterior* border, or crest of the ilium, lies above the sacral transverse process. It is concave above, convex below and thin in the middle. Internally it terminates in the posterior iliac spine, which forms the highest part of the hips. Externally and anteriorly it terminates in the anterior iliac spine which consists of four eminences, two superior and two inferior. They are more developed in some horses than in others and sometimes project so far as to form what is called "ragged hips."

The *superior* or *internal* border extends from the posterior spine to the ischium. It is sharp and thin above, becoming thicker posteriorly, presenting above the acetabulum the sciatic or superior ischiatic spine. The external border extends from the anterior spine to the acetabulum, and is concave, blunt and rough.

Ischium.

The ischium, smaller than ilium, is a flat bone, irregularly quadrilateral. which extends from the acetabulum, and forms the posterior part of the pelvis. It presents a body, shaft and ramus.

The *shaft* joins the ilium at the acetabulum, it is rounded and forms the external boundary of the obturator foramen.

The *body* is nearly horizontal, flat smooth and forms the posterior boundary of the obturator foramen. Internally it is rough and joins its fellow of the opposite side forming the symphysis ischii. Posteriorly it presents a prominent projection, the tuberosity of the ischium. The ridge running forward from the tuberosity is the inferior ischiatic spine. The posterior border is thick, running from the tuberosity to the symphysis, forming with its fellow the ischial arch. The ramus, not well developed in the horse, is the small branch which joins the pubis and forms part of the interior boundary of the foramen orale.

Pubis.

The pubis is the smallest bone of the os innominatum. It is irregular in shape and forms with its fellow the antero inferior part of the pelvis. It consists of a body and a ramus.

The *body* reaches from the acetabulum to the median symphysis. Its superior surface is concave to receive the urinary bladder, its inferior convex and crossed by a groove from the acetabulum which contains the pubic-femoral ligament. The crest is the rough anterior border which terminates in the symphysis. The posterior border extends to the ramus and forms the anterior margin of the obturator foramen. The outer extremity, which joins the ilium and ischium in the acetabulum is excavated to form the colyloid notch. The ramus is the flattened portion which extends posteriorly, joins the ramus of the ischium, forming part of the boundary of the obturator foramen and with its fellow the symphysis pubis internally.

Acetabulum.

The acetabulum, situated on the extero-lateral aspect of the pelvis is formed by the three segments of the os innominatum. It receives the head of the thigh bone and is one of the deepest articular depressions in the body It is circular in outline and except at its inferior-median part is surrounded by a lip of bone. Its inferior border presents a large notch, the cotyloid notch, continued half way across the articulation as the fundus acetabuli, to give attachment to the round ligament.

Obturator Foramen or Foramen Ovale

is the largest foramen in the body, exists in each os in nominata and is formed entirely by the ischium and pubis..

Pelvic or Posterior Extremity.

The bones of the hind limb are the femur, tibia, patella and fibula . the bones of the tarsus, viz. : the astragalus, os calcis, one cuboid and three cuneiform bones ; one large and two small metatarsals, three phalanges and three sesamoids.

Femur.

The femur or thigh bone is the largest, thickest and strongest bone in the body, belongs to the class of long bones, is placed in a direction obliquely downwards and forwards, articulating with the acetabulum and also with the tibia and patella. The shaft has two surfaces and two borders. The anterior surface is smooth, the posterior flat and expanded at its upper part and presents towards the external part of its upper third a circular roughened surface for the insertion of part of the triceps abducter muscle. The external border presents a prominent ridge, on the upper third of which is a protuberance, the trochanter minor. curved forwards. At the lower third of this border is a deep pit, the supra-condyloid fossa, and about level with this, towards the inner side, is an aggregation of tubercles forming the supra-condyloid crest.

The internal border presents near its upper third the trochanter internus, from which another ridge runs downwards, in the lower part of which is the nutrient foramen.

The proximal end terminates in the head and the trochanter major. The head is the articular surface directed forwards and inwards and is received in the colyloid cavity. It is separated from the shaft by the neck, and between the two is a roughened ridge for the attachment of the capsular ligament. There is a deep notch at the inner part of the head for the attachment of the pubio-femoral and round ligaments.

The trochanter major is a large eminence projecting upwards and outwards, the summit of which stands a little higher than the articular head. Behind the trochanter is the digital or trochanteric fossa.

The distal end presents posteriorly two condyles and anteriorly a trochlea. The condyles articulate with the head of the tibia and are separated by an intercondyloid groove, the external condyle has two fossæ on the outside, the internal condyle has a prominence on its lateral surface.

The trochlea is the pulley shaped part to the front of the condyles which articulates with the patella. It consists of two prominences separated by a groove.

Patella.

This, the knee-pan or stifle bone, is placed in front of the trochlea of the femur. Its anterior surface is convex and rough, its posterior surface smooth to articulate with the femur, presenting two concavities divided by a ridge, the superior surface is broad, the inferior surface rough and pointed.

Tibia.

The tibia, or leg bone, slants downwards and backwards between the femur and astragalus. The shaft is three sided, presenting outer, inner and posterior surfaces, all of which are wider above than below. The outer surface is concave above and convex below and smooth. The inner surface, slightly convex from side to side, is smooth except at its superior part. It is covered chiefly by skin, facia, and strong periosteum. The posterior surface, the broadest of the three, presents on its upper third a triangular and rather smooth portion, the other two-thirds being marked by a number of longitudinal ridges.

The *proximal* end presents two large, smooth, somewhat undulated articular surfaces, divided by a rough conical process, the tibial spine. The semi-lunar cartilages are interposed between these surfaces and the condyles of the femur. Anteriorly, a tuberosity, concave externally and convex internally joins the tibial ridge, and presents a vertical notch in front for the middle straight ligament of the patella. At the sides are two processes to which the lateral ligaments are attached, the external being the larger and presents an articular facet for the head of the fibula.

The distal end presents two smooth, deep articular grooves, running obliquely backwards and inwards, the internal being the deepest, the external the widest. Also three projections, the middle one dividing the grooves, is articular and continuous with them, while the others are rough outside for attachment of ligaments.

Fibula.

The fibula is a long slender bone, little developed in the horse, and is an appendage to the tibia, being attached to its outer side and extending from its head to its lower third to which it is affixed by a ligament, the space between the bones is called the tibial arch. The head is nodular, flat and rough externally. Internally it articulates with the external lateral part of the head of the tibia. Distally the bone becomes slender and tapers to a point from which a ligament is sometimes continued the whole length of the bone.

Tarsus.

The tarsus, or hock, corresponds to the ankle of man, and is composed of six irregular bones placed between the lower end of the tibia and the superior extremity of the metatarsus. They are arranged in two series, one consisting of the cuboid and three cuneiform bones the magnum, medium and parvum, corresponds to the lower row of the carpal bones, the other or upper series consists of the astragalus and calcaneum, the first, forming with the bone above the mobile portion of the joint, may be said to correspond to the upper row of carpal bones, while the latter, being the lever bone, corresponds to the trapezium. These bones are thickly covered

on their articular surface by cartilage, which acts as a protection against concussion.

Astragalus.

The astragalus or ankle bone is a pulley-like bone placed immediately below the tibia with which it articulates. (A very large portion of this bone is articular.)

The supero-anterior surface presents an articular trochlea consisting of two oblique prominences separated by a groove. The inferior surface is concavo-convex. The posterior surface is very irregular and has four facets. The lateral surfaces, the internal of which presents a tubercle inferiorly, are roughened for the insertion of ligaments. (The astragalus articulates with the tibia, calcaneum, the cuboid and great cuneiform bones.)

Calcaneum.

The os calcis or calcaneum forms the point of the hock and corresponds to the heel bone of man, is situated behind the astragalus and consists of a body and a tuberosity. The body is the inferior portion flattened laterally, slightly convex externally and unevenly concave internally, both surfaces being rough. Anteriorly, it has four articular facets to articulate with the astragalus. Posteriorly it is convex and smooth. Inferiorly it has two facets to articulate with the cuboid. The tuberosity is oblong and flattened laterally, its external surface is rough ; internally it is smooth and forms the tarsul arch, covered with fibro cartilage. Both borders are rough, the posterior one straight, and gives attachment to the calcaneo-cuboid ligament ; the anterior border is short and curved.

The superior extremity is expanded and roughened. Posteriorly it is covered with fibro cartilage for the passage of the gastrocnemius internus tendon. Anteriorly a small portion is also covered with fibro-cartilage for the gastrocnemius externus.

Os Cuboides.

The cuboid is a small, irregularly-shaped bone which occupies the outer side of the hock between the os calcis and the large and outer small metatarsal bones. It presents four surfaces.

Os Cuneiform Magnum.

The large cuneiform is the bone on which the astragalus rests. It is somewhat flat and thin, and presents two surfaces and a circumferent border.

Os Cuneiform Medium.

The cuneiform medium is somewhat flat and triangular and a little smaller than the magnum under which it is placed, articulating inferiorly with the large metatarsal.

Os Cuneiform Pavum.

This is a very irregular bone, the smallest in the hock, at the postero-internal part of which it is placed. It articulates with the large and medium cuneiform bones and with the large and internal small metatarsal bones.

Metatarsal Bones.

The large metatarsal bone presents the same general appearance as the large metacarpal, but is about one-sixth longer, flattened laterally, and rounded, and more prominent anteriorly. The inferior extremity is larger and thicker than the superior. The small metatarsals also resemble the small metacarpals, but are longer and larger, the external being the longest.

The remaining bones of the hind extremity so closely resemble those of the fore, that no description is necessary except to mention that the first and second phalanges are a little longer.

Joints of the Posterior or Hind Extremity.

Hip joint.—Formed by the head of the femur articulating in the acetabulum.

Stifle joint.—Formed by the distal end of the femur articulating with the proximal ends of the tibia and fibula, with the patella in front.

Hock joint.—Formed by the distal end of the tibia articulating with the astragalus, which articulates posteriorly with the calcaneum or os calcis which extends upwards forming the point of the hock. These bones articulate inferiorly with the cuneiform bones and the cuboid which articulate inferiorly with the proximal ends of the large and two small metatarsals.

Fetlock joint.—Formed by the distal end of the large metatarsal articulating with the proximal end of the os suffraginis, with the two great sesamoid bones behind.

Pastern joint.—Formed by the distal end of the os suffraginis articulating with the proximal end of the os coronæ.

Coffin or Navicular joint.—Formed by the distal end of the os coronæ articulating with the articular surface of the os pedis with the navicular or coffin bone behind.

Comparative Osteology.

We will now mention some of the chief differences in the bones of the horse and the ox.

In the cranium of the ox an important feature is the development of the frontal bone, which extends from below the eyes to the back of the skull, forming the entire forehead and crest, in the middle of which is the frontal tuberosity, which is very large in hornless animals. Springing from the sides of the crest are two processes, varying in size and curvature but corresponding to the shape of the horns which they support. These are the flints or horn cores which are porous in their structure, especially at their roots. They are covered with thick periosteum, and contain sinuses which are continuous with the frontal sinuses.

The parietal bone is placed below the frontal crest extending under and supporting the cores.

The occipital bone is single, wider from side to side, but smaller than in the horse, and has neither crest nor tuberosities.

The squamosal and petrosal bones are united into a single temporal bone.

The nasal bones are shorter and broader.

The superior maxilla is shorter and broader.

The premaxilla is shorter and broader, its inferior surface is flat and destitute of alveolar cavities.

The inferior maxilla is longer but less massive, the neck more constricted, and the symphysis seldom becomes completely ossified. There are eight small alveoli in front for the incisors and canines, the latter being close to the former.

The true vertebral column is made up of twenty-six segments, seven cervical, thirteen dorsal, and six lumbar. The bodies of the cervical are shorter than those of the

horse ; the dorsal longer ; the sacrum is large and more arched ; the coccygeal, thirteen to twenty in number, are stronger and more tuberous.

The ox has thirteen pairs of ribs—eight true and five false. They are straight, broad and long, and more uniform than in the horse. The distal ends are expanded to articulate with their cartilages by means of true joints. The sternum is large and flat, consisting of seven pieces, all of which unite by ossification except the first and second, between which there is a true joint.

The os innominatum is larger, but presents the same general appearance as in the horse.

The femur is distinguished from that of the horse by the trochanter minor being missing. The head is small but prominent ; the trochanter major has but one eminence.

The tibia has no articular facet for the fibula and the distal end has its external mallealus detached, forming a small bone called the malleolar bone. The fibula is wanting, being replaced by a ligament stretching the whole length of the bone.

The patella is small and somewhat conical in shape.

The tarsus consists of five bones. The astralagus is deep but narrow, having a pulley-shaped surface inferiorly as well as superiorly. The calcaneum is long and square. The cuneiform magnum and cuboid are united, forming the cubo-cuneiform bone ; the medium is like that of the horse, while the parvum is very small.

The large metatarsal has its inferior extremity divided into two equal parts by a deep fissure with a groove superiorly. The small metatarsals, when present, are rudimentary and single.

The scapula is large and very triangular. The spine does not terminate gradually in the neck, but by an abrupt angle, prolonged to a point, the acromion process ; the neck is more distinct and the coracoid process and glenoid cavity are small and close together.

In the humerus the bicipital groove is single, the external trochanter very large, and the shaft is less twisted than in the horse.

The radius is short, the ulna longer and larger, extending to the distal end of the radius and articulating with the cuneiform bone. There are two radio-ulnar arches connected by a deep fissure.

The carpus consists of six bones, four above and two below.

The large metacarpal presents a vertical groove down its anterior middle.

The inferior extremity is divided by a deep fissure into two articulations, each resembling the single one in the horse, the external one being the smaller. A rudimentary metacarpus is placed postero-superiorly.

The phalanges and sesamoids in either limb are double, one set forming each digit ; they are small and narrow. The coffin bone or os pedis resembling half of that of the horse mesially divided.

In the adult ruminant two bones are commonly found in the heart, called the cardiac bones or ossa cordis. They are found related with the auriculo-ventricular rings. They present three angles, three borders and two surfaces, the left being considerably the smaller.

Arthrology.

The several bones which form the skeleton are united by means of certain soft structures, forming a series of articulation or joints, the study of which is called Arthrology or Syndesmology.

Before considering the different kinds of joints we will briefly describe the various tissues, other than bone, which enter into, and contribute towards their formation. These are chiefly cartilage, connective and elastic tissues, and fat.

In health one bone never comes directly in contact with another, cartilage or fibrous tissue being always interposed. An exception to this exists in the adult skull, most of the bones of which become firmly united by ossification of the interposed soft material.

Cartilage.

Cartilage, known also as gristle, is a firm, bluish-white, elastic animal substance, flexible and possessing great cohesive power. That which becomes converted into bone is called temporary, and that which persists as cartilage in the adult, permanent cartilage, and it never, under any circumstances, ossifies.

Cartilage consists of corpuscles or cells, usually embedded in an intercellular substance or matrix. These

cells are oval or round, and nucleated, the nuclei, which appear under the microscope as small spots, containing still smaller spots called nucleoli.

There are three varieties of permanent cartilage, viz. : hyaline, fibro and cellular. In the first the matrix is homogeneous, or void of definite structure, appearing slightly granular under the microscope. Fibro-cartilage is characterized by a matrix of fibrous tissue, while cellular cartilage consists of an aggregation of cells without a matrix.

Hyaline cartilage is distinguished by the following names according to the purpose it serves: Articular, when it encrusts the articular surfaces of bones; Costal, when it supplies elastic prolongations to the ribs: Membraniform, when it appears as thin plates, forming permanently open tubes. (The trachea or wind pipe is formed of this kind.) Articular cartilage in the adult is nonvascular, being nourished by a vascular zone in the synovial membrane.

Fibro-cartilage consists of cartilage cells and fibrous tissues, which may be white or yellow, the former being tough and strong and the latter highly elastic. White fibro-cartilage is much the more abundant and presents the following varieties: It is called inter-articular when it appears as a pad interposed between the two articular surfaces which form a joint. Such a pad is termed a meniscus. The temporo-maxillary and femoro-tibial joints are furnished with such. Circumferential, where it surrounds and deepens an articular cavity, as the acetabulum. Connecting, where it is interposed between bones, firmly connecting them, as between the vertebral centra. Stratiform, or investing, when it clothes the parts of bones over which the tendons of muscles play. (Yellow elastic fibro-cartilage is found in the epiglottis, in the framework of the ear, and the Eustachian tubes. Cellular cartilage is found in the ear of some rodents and in the bat.)

Connective tissue, in one form or another, is found in all parts of the body. The chief varieties are the areolar and the fibrous, the former serving as a connecting medium and support to the various organs, and to the structures of which they are formed. It appears as a loose translucent mesh, its interwoven

bundles forming spaces termed the areolæ or cells, hence its name, cellular or areolar tissue. It consists of minute laminæ and filaments mixed with small fibres of elastic tissue, while cells or their remains, nuclei and walls, are also present.

The filaments which form it are mostly parallel and wavy in their arrangement. It appears in two forms, the sheeted or aponeurotic, which is found in investing ligaments, membranes, periosteum, etc., and the cordiform, in which the fibres are collected in strong bundles, as in binding ligaments and tendons. Connective tissue contains nerves and blood vessels. When healthy it is little sensitive to pain.

Yellow elastic tissue differs from the white fibrous by being yellow, elastic, and not so tough and strong, the fibres branch and join each other and their ends curl up when cut or broken. It is found in the ligamentum nuchæ, coats of arteries, etc.

Adipose tissue consists of cells containing an oily material, and arranged in isolated groups or slightly separated by meshes of areolar tissue. It is found in many parts of the body, and varies greatly in quantity. In joints it occurs between the ligaments, and serves as a packing material, while in the form of marrow it occupies the cavities of the bones.

Ligaments.

Ligaments are dense, fibrous, connecting structures existing in most articulations, and are principally made up of white fibrous tissue. They are of two kinds, viz. : capsular or bursal and funicular or binding. Capsular ligaments are membranous structures enclosing true joints. Funicular or binding ligaments consist of rounded or flattened cords, or bands of fibrous tissue, passing from one bone to another, firmly attached to roughened portions on their surfaces. Ligaments which are situated between the bones are termed interosseous. Annular ligaments are those which bind down and protect the tendons of muscles in certain joints. Some ligaments are composed almost entirely of yellow elastic tissue (such as the ligamentum nuchæ).

Synovial Membranes.

These are thin membranes lining the capsular ligaments of joints, or they are interposed between structures which move one upon another. They secrete a fluid, called synovia or joint oil, and they line closed cavities, resembling what are called serous membranes.

There are three forms of these membranes; the capsular, which line the capsular ligaments of the joints; bursal membranes, where one structure moves upon another (as where a tendon plays over a bone) and are known as synovial bursæ; when they exist between the skin and certain prominent parts of the skeleton they are known as bursæ mucosæ. The third form, vaginal membranes or sheathes, exist where one tendon forms a sheath for another, or in other canals in which tendons glide. Synovia or joint oil is a viscid, transparent fluid, colourless or pale yellow, resembling oil, but it contains very little fatty matter, consisting chiefly of albumen, salts and water. When an animal is in active exertion there is a greater demand for joint oil than when at rest, consequently there is an increased secretion of it.

Classes of Joints.

Joints may be divided into three classes. Immovable or Synarthrodial. Movable or Diarthrodial, and Mixed or Amphiarthrodial. In an immovable joint there is only a thin layer of fibrous or cartilagenous material interposed between the bones. These joints are chiefly, but not solely, found in the skull. The varieties are sutura, synchondrosis, schindylesis and gomphosis. Sutures are true and false. Variety of shape has led to the following nomenclature; sutura dentata when the processes are large and tooth-like as in the interparietal; sutura serrata where they are small and fine, like the teeth of a saw, as in the interfrontal; and sutura limbosa, where the contiguous parts are dentated and also bevelled, as in the parieto-occipital.

In the false sutures the bones are joined by plain, rough surfaces, of which there are two forms; sutura squamosa, where the adjacent borders are bevelled, the edges of one bone overlapping the other as in the parieto-temporal, and sutura harmonia where the articulating

surfaces of two bones present no marked irregularity as the nasal and premaxilla.

Synchondrosis resembles a sutura, but the connecting medium is cartilage instead of fibrous tissue (as between the basi-occipital and the basi-sphenoid).

Schindylesis is that form where a ridge or plate of one bone is received into a slit or fissure of another, as the orbito-sphenoid into the incisura sphenoidalis of the frontal bone.

Gomphosis is the form where one bone is insertec into a cavity or socket in another, as the teeth in the alveoli.

Diarthrosis.

In diarthrodial or true joints the articular surface of each bone is covered by cartilage of encrustation. The bones are held together by ligaments, the capsular one enclosing the cavity of the joint. In some joints there is a pad of fibro cartilage interposed between the two articular cartilages, called a meniscus, which adds to the freedom and elasticity of the joint.

The chief varieties of true joints are arthrodia, enarthrosis and ginglymus.

In arthrodia the motion is slight and gliding, as in the small bones of the knee and hock.

Enarthrosis, the ball and socket joint, is capable of moving in any direction, as the shoulder and hip joints

Ginglymus, or hinge joint, although it may admit of extensive motion is limited to one plane, backwards and forwards, as in the elbow.

A rotary joint (diarthrosis rotatorious) where the motion is limited to rotation, is formed by a point of one joint fitting into a ring on another (as the alto axoid joint).

Amphiarthrosis.

There is but one form of mixed joints. The term is used with reference, not to the motion, but to the structure, which partakes of the nature of both movable and immovable, the bones being joined firmly together by a strong interposed pad of fibro cartilage which is likewise adherent to the ligaments of the joint. There is no capsular ligament. Authorities differ as to whether there are synovial membranes. The joints between the vertebral centra are the best examples

Table for Reference.

Synarthrosis (Immovable)	Sutura	Vera	Dentata
			Serrata
			Limbosa
		Notha	Squamosa
			Harmonia
	Synchondrosis		
	Schindylesis		
	Gomphosis		
Diarthrosis (Movable)	Arthrodia		
	Enarthrosis		
	Ginglymus		
	Diarthrosis rotatorius		
Ampharthrosis (Mixed)			

Motion in Joint.

The following terms express the various motions allowed in joint :

Extension tends to bring two bones as nearly into a straight line as the structure of the joint will permit.

Flexion is the reverse of this.

Abduction expresses the outward movement of the limb or bone from the central plane of the body.

Adduction is the reverse movement of this.

Rotation signifies the partial revolution of a bone or number cf bones, as it were, on their own axis.

Circumduction implies the movement of the distal end of a bone or limb when it describes a curve.

The term gliding describes itself.

Ligaments of the Vertebra.

All movable joints are connected by ligaments, some of which are common, others special. The former are continuous, passing over, and uniting many vertebræ, while the latter exist separately between the contiguous segments. The common ligaments are superior and inferior common, and the supra-spinous ligaments the latter in the cervical region being called the ligamentum nuchæ. The superior common ligament extends in the spinal canal from the sacrum to the axis, placed upon the superior part of the bodies of the vertebræ,

The inferior common ligament situated below the vertebræ stretches from the sacrum only to the sixth dorsal. Posteriorly the supra-spinous ligament is a white fibrous cord, extending from the spine of the sacrum along the upper margins of the neural spines to the first dorsal vertebra, where it changes its character to yellow elastic tissue and becomes the ligamentum nuchæ, extending forward to the tuberosity of the occiput. It consists of a funicular and lamellar portion. The former is double and extends from the first, second and third dorsal spines to the tuberosity of the occiput, continuous posteriorly with the white supra-spinous ligament, in which yellow elastic tissue can be traced for some length. The right and left segments meet in the median line, and from the postero-inferior aspect springs the lamellar portion, which is flat and triangular, separating the muscles of the neck into right and left. It consists of two plates joined by cellular tissue, the bands descending from the cord and spinous processes usually of the three first dorsal vertebræ, run obliquely forward, to be inserted to the superior spines of the six posterior cervical vertebræ. This ligament is not a binding ligament. It is highly elastic and acts as a passive support to the head and neck, diminishing the muscular tension of the superior cervical region.

Some of the joints of the limbs have common ligaments, they all have special ones, with the consideration of which I will not burden you, but will just state that all the movable joints have capsular ligaments, most of them lateral and some interosseous. I may just mention some of the chief differences between the joints and ligaments of the ox and the horse.

In the ox the sternal ribs articulate with their cartilages by means of true diarthrosis, and are supplied with synovial membranes. The first segment of the sternum articulates with the second by means of a true joint. The pubio-femoral ligament is wanting in all the domesticated animals except the horse.

Myology.

The branch of anatomy which treats of the muscular system is called myology. The muscles are the active organs of motion or of locomotion, the bones and ligaments

being passive organs of the same. In order tc understand their working it will be necessary to take a brief view of their anatomical and histological structure. They contain a specific contractile substance called muscular tissue, together with areolar and fibrous tissue and a certain amount of fatty material. They are also furnished with nerves, blood vessels and absorbents.

There are two varieties of muscular tissue. viz.: the striped or striated or voluntary, and the unstriped or involuntary, the contraction and relaxation of the former being, with little exception, controlled by the will of the animal, the latter being beyond the control of the will. The chief exception to this general distinction being found in the heart and the upper part of the œsophagus which contain involuntary striated muscular tissue. Both varieties are red in colour, but the hue of the striated kind is much the deeper.

Voluntary muscular tissue forms the mass of the so-called muscles, which terminate at either extremity in fibrous structures called tendons, by means of which they are attached to bones, the fleshy portion is called the belly of the muscle.

A muscle is composed of bundles or fasciculi of fibres. The microscope shows these fibres to consist of fine filaments termed fibrillæ, which run parallel to each other. Each fibre is enclosed in a delicate tubular sheath called the sarcolemma or myolemma, composed of a transparent, tough and elastic membrane which isolates each fibre. The fibres, about 1-500 of an inch in diameter, are gathered into fasciculi, and invested with a sheath of connective tissue which is reflected between the fibres, called the perimysium internum. The entire muscle has likewise an investing sheath of connective tissue, the perimysium externum, continuous with the above. A muscular fibre, examined under the microscope will display the transverse, waving lines or striæ from which the name striated is derived. Longitudinal markings are also often apparent but less regular than the striæ.

Non-Striated Muscular Tissue,

or involuntary muscular tissue is pale in colour, and consists of fibres bound into fasciculi by areolar tissue.

The fibres never terminate in tendons and are not invested in sarcolemma. They are cylindrical in shape, and composed of elongated cells in which a nucleus is present. The contractile power exists in the cells. This tissue is very abundant, being found in the walls of the alimentary canal and hollow viscera, in gland ducts, the coats of blood vessels, the skin and elsewhere.

Both forms of muscular tissue are supplied with blood vessels and nerves. The nerves of the voluntary form coming from the cerebro-spinal system, and those of the involuntary from the sympathetic system.

Tendons.

The tendons in which voluntary muscles terminate at either end resemble ligaments in their composition, being formed of white fibrous tissue mixed with yellow elastic fibres, they are practically non-elastic. The extremity of a muscle which has the most fixed attachment is called its origin, the other extremity its insertion. The tendon of insertion is usually the longer. The tendons are prolongations of the coverings of the fibres and fasciculi at each extremity.

Fascia.

Each group of muscles is invested and bound down by a strong expansion of white fibrous tissue called fascia, which is firmly attached to the bone. This term is also applied to a membranous expansion below the skin which forms a continuous covering over the whole body, composed of connective tissue more or less condensed, this is called superficial fascia.

Aponeurotic fascia is that form which covers, supports and binds down groups of muscles; it unites to, and blends with the periosteum. Fascia is also found in connection with the walls of cavities, as in the pelvis. (In the limbs where muscles form lengthy masses, with long tendons, there would be considerable displacement during motion, were it not that in these parts the fascia is very strong.)

Muscular Nomenclature.

Some muscles are named from their form, others from their use, others from their situation, others from their direction, others from their attachment, etc.

Time will not allow us to enter into an exhaustive study of the individual muscles, but we will consider some of the most important ones.

Particular Muscles.

The *Panniculus Carnosus* is spread over the greater part of the body, as the face, neck, thorax and abdominal portions, these being all continuous. It is, as a whole, aponeurotic superiorly, becoming more fleshy as it descends. It is related with the skin externally; internally with the superficial layers of muscles. Its action is to corrugate the skin, and thus enable the animal to expel insects and irritating bodies.

The *Obliquus Abdominis Externus* is situated on the infero-lateral aspect of the abdomen. It is attached to the outer surface of the last fourteen ribs, just below their middle, to the fascia of the latissimus dorsi, and superiorly to the lumbar fascia, to the anterior spine of the ilium, to the pelvis, and to the linea alba throughout its whole extent. Its action is to support and compress the abdominal viscera, and assist in defecation, urination and parturition. It is also a flexor of the vertebral column, and a muscle of expiration. There are also the obliquus abdominis internus, rectus abdominis and transversalis abdominis which have a similar action.

Antea and *Postea Spinati* muscles occupy the fossæ of the scapula, and the antea is inserted inferiorly by two tendons to the internal and external trochanters of the humerus, its action being to extend the humerus on the scapula, and to bind the joint like a ligament. The *postea* spinatus is inserted inferiorly by two tendons, one of which is attached to the inner side of the convexity of the external trochanter, the other passes over the convexity and is attached to the ridge below. Its action is to abduct the humerus and rotate it outwards.

The *Flexor Brachii* is the analogue of the biceps in man, and is situated in front of the humerus, is attached superiorly to the coracoid process of the scapula, and

passes over the bicipital groove, where there is a synovial bursa, and is attached inferiorly to the antero-internal part of the radius. Action, to flex the radius on the humerus and extend the latter on the scapula.

The *Levator Humeri* occupies the infero-lateral part of the neck, extending from the back of the head to the arm. It is attached anteriorly to the crest of the occiput, and mastoid process of the temporal bone, and the wing of the atlas; to the transverse processes of the second, third and fourth cervical vertebræ and the fascia of the neck. Inferiorly to the deltoid ridge of the humerus, and the fascia of the muscles of the shoulders and arm. Action, when the head is fixed it advances the entire limb. If the limbs are fixed it aids in turning the head and neck to one side, or, with its fellow, in depressing them.

The *Extensor Pedis* is attached superiorly to the external condyle of the humerus, to the outer and upper part of the radius; and inferiorly to the lower part of the os suffraginis, os cornea and the pyramidial process of the os pedis. Its action is to extend the fore foot and pastern, and at the same time assist in extending the knee.

The *Flexor Pedis Perforatus* is attached superiorly to the lower side of internal condyle of the humerus; and inferiorly to the upper and back part of os coronæ. Its action is to flex the fetlock and pastern joints, and assist in flexing the knee.

The *Flexor Pedis Perforans* is attached superiorly to the same as the preceding muscle; and inferiorly to the posterior concavity of the os pedis. The tendon passes down the back of the limb anterior to the perforatus, and passes through the latter near its insertion. Its action is to flex the joints below the carpus and assist in flexing the latter.

The *Diaphragm* is the muscular partition which separates the thoracic from the abdominal cavity. It slopes obliquely downwards and forwards and is in form elliptical or heart shaped, being wider superiorly. The thoracic portion is convex, and lined by pleura, the abdominal concave and lined by peritoneum. Its centre is tendinous, and its periphery muscular. It is divided into a body and two crura. It is attached anteriorly

and inferiorly to the cartilages of the last 12 ribs, also to the ensiform cartilage; and posteriorly and superiorly to the bodies of the lumbar vertebræ. Near its centre, and a little to the right is a large opening called the foramen dextrum, through which passes the posterior vena cava. Between the pillars superiorly is a second opening, the hiatus aorticus, through which passes the posterior aorta, vena azygos, and thoracic duct. Below this is the foramen sinistrum for the passage of the œsophagus.

The *Linea Alba* is a white fibrous cord or band, attached anteriorly to the inferior surface of the ensiform cartilage, and posteriorly it unites with the prepubian tendon which is attached to the anterior border of the pubis, and assists in forming the inguinal canals. Between its posterior and middle thirds the linea alba is enlarged, and forms a space, in the centre of which is the remnant of the umbilicus. It gives attachment to the abdominal muscles.

Digestive Organs.

Before describing the anatomy of the digestive, respiratory, urinary and genital systems, it will be advisable to allude briefly to certain tissues and structures which are closely associated with them. They are. epithelium, mucous and serous membranes and glands.

Epithelium is a cellular tissue, which, in one form or another, covers all the free surfaces of the body, that is, the skin and mucous membranes · one variety of it also covers the inner surfaces of closed and airtight membranes. this is called endothelium. The following varieties of epithelium are described, viz: squamous, columnar, spheroidal and ciliated. Squamous consists of flattened scaly cells. Endothelial cells are of this variety. In columnar epithelium the cells are cylindrical in form, and arranged side by side, with their long axis perpendicular to the subjacent surface. Spheroidal epithelium is found in the follicles and ducts of glands, and is called glandular epithelium, it is also spherical in shape. Ciliated epithelium consists of columnar cells, provided at their free extremities with delicate hair like processes or cilia, which wave to and fro in a marked manner. This form

is found in the mucous membranes of the air passages, where its cilia tend by their motion to expel particles of foreign matter which may be inhaled by the breath.

Mucous Membranes.

This structure is widely diffused, lining the canals of the four systems under consideration, and being continuous with the skin at each of their orifices. A mucous membrane consists of one or more layers of epithelial cells placed upon a modified form of connective tissue, and serving as a matrix in which are situated the nerves and vessels of the membrane, along with numerous glands. The secretion of the glands proper to the mucous membranes is mucous, a viscid fluid which lubricates their free surfaces. The surface of a mucous membrane may be smooth, as in the air passages, or it may be papillated; that is, furnished with small projections called papillæ, as in the tongue. It may be rugeous, or thrown into folds or rugæ, as in œsophagus and stomach. In the small intestines it presents small finger-like projections called villi. It is then said to be villous, and in the same situation the membrane presents valve-like folds and may be termed valvular.

Serous Membranes.

The closed cavities of the body are lined by structures of this class. By a closed cavity we mean a receptacle, impervious, under normal conditions, to the atmospheric air. A serous membrane consists of an endothelial and subendothelial portion. A serous membrane is arranged so as to line a closed cavity, and at the same time cover its contents, hence it follows that the entire membrane must form a closed sac. The fold of the membrane which lines a cavity is called the parietal; that which covers its contents the visceral portion. The two surfaces contacting and gliding upon each other are lubricated by a fluid secretion contained in the sac.

Glands are organs in which is carried on the process of secretion, or separation from the blood of certain matters which may be required to assist in the various vital functions, or to separate from the blood effete or poisonous material. Most glands resemble a mucous membrane, consisting of epithelial, sub-epithelial, vascular

and nervous portions. The vessels supply the glands with blood from which the secretion peculiar to the gland is separated by the vital power of the cells. The secretions of glands are as a rule discharged on the free surfaces of the body; that is, on the mucous membranes or the skin, by means of tubes known as gland ducts; hence such glands may be regarded as depressions in the mucous membranes or skin. The ductless glands form a group which differs from the above in the absence of a duct, the secretion being usually carried away by rupture of the glandular sac, or by absorption into the neighbouring lymphatics.

The *digestive* organs comprise the alimentary canal and its accessories, by which the alimentary matter is received and subjected to specific actions which adapt it for the purposes of nutrition. The functional processes of digestion are :—

1. Prehension or the taking of the food into the mouth.
2. Mastication or chewing the food.
3. Insalivation or the mixing of the food with saliva.
4. Deglutation or swallowing.
5. Chymification or the conversion of the food in the stomach into chyme, by maceration and the action of the gastric juice.
6. Chylification, or conversion of the chyme into chyle, which takes place in the duodenum by the agency of the biliary and pancreatic secretions.
7. Absorption of the nutrient material into the circulation.
8. Defecation, or expulsion of the residual inert matter.

The alimentary canal is a musculo-membranous tube extending from the lips to the anus. We will consider the different parts in the order in which the food traverses them. The *mouth* contains the organs of taste and the instruments of mastication. It is situated between the jaws, is bounded in front by the lips and their aperture, laterally by the cheeks, above by the hard palate, the floor is occupied by the tongue, while the posterior boundary is the soft palate.

The *labia* or lips are movable fleshy curtains surrounding the anterior opening. They consist of skin and mucous membrane, which enclose muscles, vessels, nerves, areolar

tissue, fat, and certain labial glands. They are the organs of touch as well as prehension.

The *buccæ* or cheeks resemble the lips as regards tissue, but are more muscular. The mucous coat is called the buccal membrane, and is provided with buccal glands similar to the labial. The cheeks serve during mastication to support the food and press it between the molars.

The *hard palate* or roof of the mouth extends from the incisor teeth to the soft palate. It consists of a layer of mucous membrane, with a layer of dense fibrous tissue, firmly attached to the bony palate. It is crossed transversely with from seventeen to twenty arches with concave surfaces behind. The hard palate forms a fixed surface against which the tongue can manipulate the food.

The *soft palate*, or velum pendulum palati, "as it is called," is the valvular curtain suspended between the mouth and the pharynx, and consists of a double fold of mucous membrane, enclosing muscles, glands, vessels and nerves. It is owing to the great size of this that the horse is unable to breathe through the mouth and to resist swallowing.

The *tongue* is a movable, musculo-membraneous organ, situated on the floor of the mouth between the rami of the lower jaw. It is the special organ of taste and at the same time materially assists in mastication and deglutation. In the ox it is prehensible, and the carnivora lap or prehend fluids with it.

The *salivary glands* are accessories of the mouth. They secrete the saliva which is discharged into the mouth, and saturates the food during mastication; during mastication these glands are very active; at other times not nearly so much so. There are three pairs, viz., the Parotid, Submaxillary and Sublingual.

The *Parotid* glands are the largest of the salivary glands and are situated in the space, one on each side, bounded by the posterior border of the inferior maxilla and the anterior border of the wing of the atlas, lying immediately below the ear. A duct, called Steno's duct, conveys the saliva into the mouth. It commences from the antero-inferior surface of the gland, passes around the ramus of the jaw, running around the anterior border of the masseter

muscle, and enters the mouth at the level of the third molar tooth.

The *Submaxillary Glands* are smaller than the parotid, and lie in the maxillary space below and behind the parotid. They extend from the wings of the atlas to the body of the hyoid bone, where they terminate in what are called Wharton's ducts, which open into the mouth in front of the frænum linguæ.

The *Sublingual Glands* are smaller than the last named, and are situated under the tongue. In the horse they open by fifteen to twenty small ducts each—the ducts of the Rivinus—along the floor of the mouth. There are several minor salivary glands, viz., the Molar, the Labial, the Lingual and the Staphyline. The Molar, so called because they are parallel to the molar alveoli, are two in number situated in the cheeks. The Labial are situated in the lips, as the word indicates. The Lingual glands are found at the base of the tongue and partly along its sides. The Staphyline glands are situated in the soft palate.

Saliva.—The saliva is a clear, viscid and colourless fluid, slightly saline in taste. It is alkaline in reaction. It consists of water with about ½ per cent. of solids, including fat, albumen and a special nitrogenous principle called ptyalin, which helps to convert starchy matter into grape sugar. It also contains alkaline and earthy salts. The food thus becomes saturated in the mouth with two fluids, mucous and saliva, both assisting in mastication and deglutation, the saliva in addition acting on the starchy constituents of the food.

Odontology, or Study of the Teeth.

Teeth.—The teeth are composed of the hardest tissues of the body, and consist of 76½ per cent. earthy salts. Teeth vary with the class of animal in number, size form, structure, situation, etc., but in all cases they are in correlation with the food and generic habits of the animal. Thus in herbivora, where grinding the food is necessary, the contacting surfaces of the molars are rough and flat. In carnivora, where tearing and crushing are requisite, the molars are sharp, pointed and serrate. In omnivora, where the food is general the teeth are mixed in their character. The form of the teeth thus

depends upon the natural food of the animal, and there is always a certain harmony between their disposition and the conformation of correlated organs. Teeth are not found in all animals. Birds have none.

Three hard substances enter into the formation of teeth, viz.: Dentine, or Ivory; Enamel; and Cementum, or Crusta petrosa.

Dentine constitutes the major part of the tooth and is a hard, yellowish substance consisting of very minute tubuli embedded in a dense, granular, intertubular matrix, which contains the bulk of the earthy matter, the latter being about 30 per cent. of the whole.

Enamel is distinguished by its peculiar whiteness. It is the hardest animal texture, containing about 96 per cent. of earthy salts. No nutrient nerves or vessels have been traced into enamel, and when destroyed it is not reproduced. This tissue is protective, sometimes covering the entire exposed surface of the tooth, as in man and the dog. It also furnishes the rough projections and cutting edges found in the teeth of some classes of animals, as in herbivora.

Crusta Petrosa, or Cementum, completely covers the embedded portion of the tooth, and occupies the cavities on the free portion, where such exist. It is the softest dental texture closely resembling true bone in structure, and is of brownish yellow colour. The proportion of earthy matter is about 67 per cent., the same as in bone.

Arrangement and Kinds of Teeth.

Teeth may be simple or compound.

Simple, as in the dog, where the entire exposed surface is covered by a solid cap of enamel, which alone is in wear.

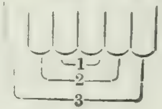
Compound, or complex, as in the horse, where various tissues are in wear.

Teeth are arranged along side of each other, so as to form the dental arches; these are interrupted at each side, leaving the interdental spaces.

There are three kinds of teeth, viz., the incisors, or cutting teeth, situated in front of the arches; canine teeth, or tusks, in the interdental spaces; and molars, or grinders, behind. The horse, like many other animals,

has two sets; the temporary, or milk teeth, and the permanent, or horse teeth, the former numbering 24 and the latter 40. In the mare there are usually but 36 permanent teeth, the tusks usually being wanting or rudimentary. The temporary incisors are small, white, and have no grooves, and are constricted at the neck. On the table surfaces of these, when young, there are two rings of enamel, an outer and an inner ring, the space between the two being filled with dentine, while that within the inner ring is occupied by crusta petrosa, which becomes stained, constituting the so-called mark. This funnel-shaped cavity is called the infundibulum. The fangs of teeth are inserted in sockets or alveoli. The alveolar processes are the bony parts of the jaw in which the fangs are inserted. The pulp cavity runs up the fang centre, and contains a highly vascular and nervous organ, the pulp, whence the dentine of the tooth grows. It is owing to the extreme sensibility of the nerve of the pulp that toothache is so severe when the pulp is exposed. I will now mention the order and age at which teeth make their appearance.

Incisor teeth are 12 in number, 6 above and 6 below.



1. Central. 2. Lateral. 3. Corner.

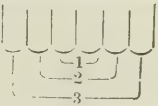
Table Showing Number of Teeth in Different Animals.

	Incisors.	Canine.	Molars.	Total.
Horse	$\frac{6}{6}$	$\frac{2}{2}$	$\frac{12}{12}$	40
Ox	$\frac{0}{8}$	$\frac{0}{0}$	$\frac{12}{12}$	32
Dog	$\frac{6}{6}$	$\frac{2}{2}$	$\frac{12}{14}$	42
Pig	$\frac{6}{6}$	$\frac{2}{2}$	$\frac{14}{14}$	44
Sheep	$\frac{0}{8}$	0 / 0	$\frac{12}{12}$	32

Most colts at birth have four incisors and always twelve molars. If the incisors be not present they appear at about fourteen days old. At from six to nine weeks the lateral incisors appear, and from six to nine months the corner.

Temporary Incisors.

Permanent Incisors.

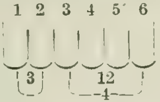


1. Birth. 2. 9 weeks. 3. 9 mos.

1. 3 yrs. 2. 4 yrs. 3. 5 yrs.

At from nine to twelve months the first permanent molars appear ; at about two years the second. At from two and a half to three years the first two temporary molars are shed, and permanent ones take their place ; and at from three and a half to four the third temporary molar is shed and replaced by a permanent one, and the sixth permanent tooth appears.

Permanent Molars.



1. 1 year. 2. 2 years. 3. $2\frac{1}{2}$ to 3 years. 4. $3\frac{1}{2}$ to 4 years.

At 5 years a horse usually gets his canine teeth.

At 6 years the marks disappear in the central lower incisors.

At 7 years the marks disappear in the lateral lower incisors.

At 8 years the marks disappear in the corner lower incisors.

At 9 years the table surface of all the lower incisors is comparatively smooth.

At 10 years the marks disappear in the central upper incisors.

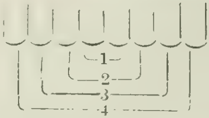
At 11 years the marks disappear in the lateral upper incisors.

At 12 years the marks disappear in the corner upper incisors.

After this age, and to a certain extent after 8 years, evidence of age is to be obtained from the tables of the incisor teeth, by their form, the extent of the central cavity, and the general appearance of the mouth. As a horse grows old the shape of the incisors change, they become longer, narrow from side to side and deeper from before backwards.

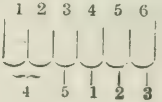
DENTITION OF THE OX.

Permanent Incisors.



1. From 1 year 7 months to 2 years.
2. From 2 years 3 months to 2 years 6 months, or possibly not until 3 years.
3. From $2\frac{1}{2}$ to 3 years. In forward animals sometimes well up at $2\frac{1}{2}$ years.
4. From $3\frac{1}{2}$ to 4 years. Not much reliance can be placed on these teeth, as they may appear any time from 2 years 10 months up to 3 years 9 months.

Permanent Molars.



1. At 6 months.
2. At 1 year to 15 months.
3. At 1 year 8 months to 2 years.
4. At 2 years to 2 years 6 months.
5. At $2\frac{1}{2}$ to 3 years.

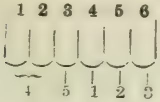
Well bred cattle get their teeth, as a general thing, earlier than common bred ones. Some have a full mouth of incisors at 3 years. Usually a full mouth of molars at 3 years.

DENTITION IN SHEEP.

Permanent Incisors.

1. From 1 year to 15 months.
2. From 18 months to 2 years.
3. From 2 yrs. 3 mos. to 2 yrs. 9 mos.
4. From 3 to 4 years.

Permanent Molars.



1. At 3 months.
2. At 9 months.
3. At 18 months.
4. Shortly after 18 months.
5. At about 2 years, or shortly after the first and second.

Dentition in sheep is irregular, the same as in the ox, owing to breed, care, food, etc: well bred and well cared for animals teething earlier than those coarser bred and poorly cared for.

Pharynx. The pharynx is a musculo-membranous cavity, common to the digestive and respiratory canals. It is situated between the soft palate and the opening of the œsophagus. It has seven openings into it, viz.: two posterior nares superiorly. Eustachian tubes (which lead to the guttural pouches) posteriorly, on either side; the isthmus of the mouth guarded by the soft palate anteriorly; and the openings of the œsophagus and larynx behind, the laryngeal opening being inferior.

The *Œsophagus*, or gullet, is a musculo-membranous tube passing from the pharynx to the stomach, through which the food reaches the latter. It descends the neck, at first behind the trachea, then inclines to its left, the two entering the thorax together, passes over the base of the heart, and through the diaphragm by the foramen sinistrum. Gaining the abdominal cavity it terminates in the cardiac orifice of the stomach. It consists of two tunics, an internal mucous, and an external muscular. It presents numerous longitudinal folds which allow of considerable dilatation. At the entrance to the stomach these folds form a sort of valve which prevents regurgitation of food.

Abdomen. The abdomen, or belly, contains the ultimate organs of digestion. It is a large cavity, bounded superiorly by the muscles of the sublumbar region, inferiorly and laterally by the abdominal muscles, anteriorly by the diaphragm, posteriorly it is continuous with the pelvic cavity. It contains the stomach, intestines and kidneys with their accessories. It is lined by the peritoneum, which is reflected over the viscera.

The *Stomach* is a dilatation of the alimentary canal, continuous with the œsophagus and small intestine; where the food is converted into chyme by the action of the gastric juice. In the horse it is small compared to the size of the animal, and is situated on the left and anterior part of the abdomen. It is divided by a central constriction into a left or cardiac, and a right or pyloric portion. It has two openings, one on the left opening into the œsophagus called the cardiac orifice, and one on the right opening into the intestine, called the pyloric orifice. The walls of the stomach are composed of three coats, viz.: an external serous, middle muscular and an internal mucous coat. The serous coat is a reflection of the peritoneum. In the muscular coat the fibres are so arranged that their contraction and dilatation produces a churning motion, which macerates the food, and brings each portion of it in contact with the mucous membrane

The *Mucous Coat* is divided into right and left sections. The latter, called the cuticular portion is continuous with the mucous membrane of the œsophagus, which it resembles. The line between the two portions is well marked. The right portion, called the villous, or true digestive portion is reddish in colour, soft, very vascular and velvety looking. The follicles which secrete the gastric juice are found in this coat.

The *Intestines* form a musculo-membranous tube, and are divided into small and large, the small intestine being continuous with the stomach at its pyloric orifice. These organs are tortuous in their course, and in herbivora are large and capacious.

The *small Intestine* commences at the pylorus, and terminates in the cæcum. It consists of a convoluted tube, rather more than an inch in diameter, and about 72 feet long. It is divided into the Duodenum, Jejunum and Ileum.

The *Duodenum*, on leaving the pylorus runs forward, then backward, forming an abrupt curve. This is the only fixed portion of the small intestine, is about one foot in length; and four or five inches from the pylorus is the opening of the ductus communis, a duct common to the liver and pancreas. The *Jejunum* succeeds the duodenum, and includes about two-fifths of the remainder

of the small intestine, the *Ileum* constituting the rest. Both are floating, that is, they are hung in folds of the mesentery. The Ileum terminates in the right and posterior. portion of the abdomen. The walls of the small intestine, in common with all hollow viscera of the abdomen, have an external serous, a middle muscular and an internal mucous coat. The mucous coat is soft, reddish and vascular, and covered by villi and follicular openings, and furnished with glands and absorbents. Glands of Brunner, Crypts of Lieberkuhn, Peyer's patches and Solitary glands. (The first two secrete fluids which aid digestion, but the latter two are ductless and their function not known.) The absorbents originate in the villi, which are small finger-like valvular processes thickly distributed over the mucous membrane. They consist of loops of the lacteal or chyle vessels, surrounded by a network of capillaries, fine muscular fibres, and small granular corpuscles with a mucous layer covered by epithelium.

In the duodenum the chyme becomes saturated with the bile and pancreatic juice. This is called chylification, or the conversion of chyme into chyle. Chyle is a milky like fluid and is absorbed by the lacteals throughout the remainder of the small intestine.

The *large Intestine* extends from the termination of the Ileum to the anus, and consists of four parts, viz. : the Cæcum, Great Colon, Floating Colon and Rectum.

The *Cæcum*, or blind intestine, is a large Cul-de-sac, commencing at the termination of the Ileum, and passing downwards and forwards towards the sternum, and terminating in a pointed, blind extremity. It measures about 36 inches, and has an average capacity of six gallons. The superior extremity is called the base or arch, and presents a convex curvature directed backwards, and a concave one directed forwards. In the concave curvature the ileum terminates and the colon originates. The opening in which the ileum terminates is situated inferiorly and is guarded by the ileo-cæcal valve, a double fold of mucous membrance. In the mucous coat we have neither Brunner's glands nor Peyer's patches. The follicles of Lieberkuhn, solitary glands and a few scattered villi are, however, present.

The *Great Colon* originates from the cæcum, and terminates near its origin in an abrupt contraction, whence

arises the floating colon. Leaving the arch of the cæcum the large colon passes downwards and forwards to the posterior surface of the diaphragm, where it turns to the left and passes upwards and backwards, and terminates near its origin. It is a voluminous tube with successive dilated and constricted portions, is about nine to eleven feet in length, with a capacity of about eighteen gallons.

The *Floating Colon* succeeds the great colon, and is convoluted like the small intestine, but is twice as large, is about ten feet in length. It chiefly occupies the left flank, and at the anterior part of the pelvis it terminates in the rectum. It is supplied with regular transverse folds and longitudinal bands, the action of which form what are called dungballs.

The *Rectum*, or straight intestine, extends in a straight line from the entrance of the pelvic cavity to the anus, and resembles in structure the floating colon, but has thicker and more dilatable walls. It is related superiorly with the sacrum; inferiorly with the bladder in the horse, and with the vagina and uterus in the mare.

The *Anus* is the posterior opening of the alimentary canal. It forms a round projection which becomes less prominent with age. It is composed principally of muscular tissue.

Accessory Organs of Digestion.

In the abdominal cavity these organs are the Liver, the Pancreas, and the Spleen.

The *Liver* is a solid gland situated in the abdomen, behind and to the right of the diaphragm. It is the largest secreting gland in the body, weighing from ten to twelve pounds, is thick in the centre gradually thinning towards the border, and presenting numerous clefts. It has two surfaces and a circumference. The anterior surface is smooth and convex and cleft by a deep fissure, in which lies the posterior vena cava. The posterior surface is smooth and convex and marked superiorly by a large transverse fissure by which the vena porta enters, and the hepatic canals leave the liver. The circumference may be divided into a superior left and an inferior right. The inferior is cleft by two fissures which divide the organ into three lobes. It is held in position by six ligaments.

The coverings of the liver are an external serous and an internal fibrous coat. The serous is a reflection of the peritoneum. The inner coat consists of a thin fibrous membrane adherent to the glandular substance. It is called Glisson's capsule. It covers the entire gland, and penetrates the organ, forming sheathes for the vessels, and separating the hepatic lobules. The liver consists of minute lobules separated from each other by reflections of Glisson's capsule. Each lobule consists of numerous cells, biliary ductlets and vessels. The cells are arranged in rows radiating from the centre of the lobule. The liver is supplied with nutritive blood by the hepatic artery, and with functional blood by the portal veins both kinds of blood being returned by the hepatic veins The hepatic duct leaves the liver at the transverse fissure and is called the ductus choledochus, and is formed, by the union of the branches of the hepatic ducts. This duct joins that of the pancreas at the duodenum, about five inches from the pylorus, and is called the ductus communis. The blood of the portal vein, returning chiefly from the intestines, is charged with bile, which it is the principal function of the liver to remove. This is achieved by the vital power of the hepatic cells. Bile is a greenish coloured viscid fluid, with a bitter taste, and an alkaline reaction, believed to stimulate peristaltic action, and the secretion of the glands in the mucous membrane. In solipedes the secretion of bile, although more active during digestion, is constant, there being no reservoir, or gall bladder for it. Most animals are supplied with a gall bladder, in which the bile accumulates, and passes into the intestinal canal when digestion commences.

The *Pancreas* resembles the salivary glands in structure and physical properties, but is looser and softer and of a reddish cream colour. It is situated behind the stomach and liver, and in front of the kidneys. An oblique opening, "the ring of the pancreas," passes from the inferior to the superior surface, through which the portal vein runs in its passage to the liver. The duct of this gland, "the duct of Wirsung," joins the hepatic duct to form the ductus communis. The pancreatic secretion is clear and colourless. It mixes with the chyme and assists in chylification by emulsifying the fatty materials, and rendering the latter fit for absorption.

The *Spleen* is a soft, reddish organ, situated on the left side of the great curvature of the stomach. It is an exceedingly vascular, ductless gland, having no excretory canals. In the horse it is somewhat scythe shaped, the apex being directed downwards and forwards. It is elastic and distensible, and consists of a serous and fibrous coat enclosing the tissue proper to it, or "parenchyma." The serous coat is a reflection of the peritoneum. The fibrous coat or proper capsule, covers the organ and sends processes into it, forming a network in which is contained the splenic bulb, a red looking material resembling clotted blood. Some of the arteries of this organ terminate in the interlobular space, whence veins arise. Embedded in the spleen pulp are numerous white bodies, called "Malpighian corpuscles," which are attached to the smaller arteries. The function of the spleen is not well understood. It is regarded by some to be an internal refuge for blood when cold is applied to the superficies of the body. Some maintain that it forms blood corpuscles, and others that it is the agent of their destruction, and again others that they are both formed and destroyed in it.

The *Peritoneum*. The abdomen and part of the pelvis are lined by peritoneum. Like all other serous membranes, it has a parietal and visceral portion, which together form a complete sac, with the organs it covers situated on its outer side. The internal surface is smooth, free, moist, and secretes a serous lubricating fluid. The external or attached surface adheres to the walls of the abdomen and pelvis, and to the outer surface of the viscera, the former being the parietal and the latter the visceral portion. In order to suspend the different organs it is formed into ligaments, mesenteries and omenta. Ligaments consist of two folds strengthened by fibro-elastic tissue. A mesentery is a double fold of peritoneum attached to the abdominal walls above, and containing a portion of intestine in its free extremity. An omentum is a double fold passing from one abdominal organ to another.

Physiology of Digestion.

Digestion is that process by which the food is prepared for absorption and assimilation.

Hunger is the general want of nourishment in the system. The introduction of food alone into the stomach

will not allay the sensation. It must enter into the circulation. The sensation is thought to be due to a congested condition of the capillaries beneath the mucous membrane

Thirst is the general want of fluids in the system referred to the throat, may be allayed by introducing fluids into the stomach or injecting it into the veins, or immersing the body in a bath.

Prehension, etc., have been described.

Chymification is effected in the stomach. In the mucous membrane of the stomach we have numerous mucous and peptic follicles, the former secrete mucous and the latter gastric juice. This membrane is abundantly supplied with blood vessels. The nerves are derived from the pneumogastric and sympathetic nerves.

Gastric juice is a clear, colourless fluid of an acid reaction, secreted only during digestion or as a result of irritation. The quantity of gastric juice secreted during 24 hours is large, 10 to 12 pints, it is in part reabsorbed. The secretion is much influenced by nervous conditions. Is diminished by temper, fear, joy, fatigue, mental exertion, or any febrile disturbance of the system.

Chemical composition of human in 1,000 parts :

Water	994.40
Pepsine	3.19
Hydrochloric Acid	.22
Salts	2.19

Gastric juice is acid. It has a liquefying action on the food by catalysis. It acts on the nitrogenous portions of the food, and saccharine matter is rendered fit for absorption in the stomach, while the starchy matter and fat pass into the bowels before being changed.

Chylification takes place in the small intestine, but principally in the duodenum. The starch and fat pass unchanged into the small intestine where they come in contact with the mixed intestinal juices, and are reduced to a state fit for absorption. These juices are the secretions of Brunner's glands, the follicles of Lieberkuhn, the pancreatic juice and bile. These juices have an alkaline reaction. The secretion of Brunner's glands and the follicles of Lieberkuhn act on the starch, converting it into sugar, rendering it fit for absorption.

The pancreatic juice also acts on the starch, as well as assisting in the digestion of fat. It further assists in the complete digestion of nitrogenous matters that have escaped the gastric juice.

Bile is a thick, viscid fluid, of a greenish colour, a bitter taste, and nauseous smell. It aids in the digestion of fat. It also contains substances removed from the blood by the liver, which, if allowed to remain, would be poisonous. It is the natural purgative of the body. It also prevents decomposition of fæcal matters.

The function of the large intestine is mainly confined to the separation and discharge of the fæces. The ileo-cæcal valve prevents a reflux of the contents of the large intestines. The surface of it towards ileum is covered by villi, while the rest is almost destitute. Fluids are absorbed in the large intestine, so that the longer the fæces remain there the dryer they become. Nutritive fluids can be absorbed. The fæces are urged on by the vermicular action of the intestine to the rectum, where they accumulate, and are prevented from escaping by the contraction of the anus. The accumulated matter causes a sensation demanding its discharge, which is effected by the contraction of the abdominal muscles, diaphragm and rectum, overcoming the muscular fibres of the anus.

The *Spleen* is thought to be a storehouse for nutritious material which may be drawn on as the system requires, also an agent in forming colourless corpuscles of the blood.

Respiratory System.

By the action of these organs certain chemical and physical changes take place in the blood. The chief of these consisting in the absorption of oxygen from, and giving off carbonic acid to, the atmospheric air; the former being necessary for the elaboration of the fluid, the latter for the elimination of a substance which, if retained, would prove prejudicial. Respiration is carried on in the mammalia by means of elastic air receptacles called lungs, which are enclosed in special cavities, and communicate with the atmospheric air by means of an air tube. In the horse, who breathes only through the nostrils, the organs of respiration are the

Nostrils, Nasal Chambers, Pharynx, Larynx, Trachea, and in the thoracic cavity the Bronchi, Bronchial tubes, and Lungs.

The *Nostrils* are situated at the anterior extremity of the nasal chambers, and are right and left. They consist of an incomplete cartilaginous skeleton covered by muscles, and lined internally by mucous membrane. They are bounded by movable wings or alæ. The commissures of the alæ are a superior and an inferior. The superior is the false nostril, the finger introduced into which, enters a cul-de-sac. The inferior commissure is large and round, and has, at a short distance within, an opening, sometimes double, which is the inferior opening of the lachrymal duct. The nostrils have the power of dilating and contracting considerably, their use being to give passage to the air during inspiration and expiration.

The *Nasal Chambers* are cavities extending from the ethmoid bone to the nostrils, and are separated from each other by the septum nasi, which forms the internal wall, the external is formed by the superior maxilla. Each chamber is divided into three passages, a superior, middle and inferior. There are two turbinated bones in each chamber, the inferior and superior. They are formed of very delicate convolutions of bones void of periosteum ; their use is to augment the surface of the nasal chambers over which the olfactory nerve is distributed, while by their lightness they add very little to their weight. The nasal chambers are lined by a very delicate, pale, rose coloured mucous membrane, called the pituitary, or schneiderian membrane ; it is very delicate and contains the special sense of smell.

The *Pharynx* is common to both digestive and respiratory systems, and has been described.

The *Larynx* is a complete musculo-cartilaginous valve, situated at the anterior extremity of the wind-pipe. It gives passage to the air, and is the organ of voice. The anterior extremity opens into the pharynx, and the posterior is continuous with the trachea. It is composed of seven cartilages, three singles and two pairs. The former are the Cricoid, Thyroid and Epiglottis, and the latter the Arytenoid and Cuneiform.

The *Cricoid*, or ring-like cartilage, is situated at the base of the larynx surrounding the air passages.

The *Thyroid*, or shield-like cartilage, is the largest. It consists of two lateral expansions which unite antero-superiorly at a rather acute angle, forming a projection called the body of the Thyroid, which corresponds to the pomum adami in man.

The *Arytenoid*, or ewer-shaped cartilages, a pair, lie upon the cricoid, and bound supero-posteriorly the entrance of the larynx. They are irregularly pyramidal, and their anterior surface forms a lip or spout, in which rests the epiglottis when the larynx is closed.

The *Epiglottis* is a soft leaf-like cartilage, flexible, and situated in front of the opening to the larynx, which it completely closes during the passage of food to the œsophagus. Its anterior surface is attached to the tongue and hyoid bone. From its base two lateral cartilages extend backwards. These are the *cuneiform* cartilages, a pair, and they are situated in the folds of the mucous membrane, which stretch from the epiglottis to the arytenoid cartilages, together forming the false vocal cords

The true vocal cords are formed by the thyroarytenoidean ligaments covered by mucous membrane, and the narrow passage between them is called the glottis, or Rima glottidis. Between the true and false vocal cords on either side is a deep fossa, the ventricle of the larynx.

The *Trachea*, or wind pipe, a nearly cylindrical, flexible tube, consisting of a series of incomplete cartilaginous rings. It succeeds the larynx, runs down the neck, enters the thorax, and terminates at the base of the heart, where it divides into right and left bronchi. It varies in length, there being from 40 to 50 rings, the ends of which overlap each other superiorly. It presents a number of transverse furrows which correspond to the interspaces between the rings. The extremities of the incomplete rings are joined by ligaments which contain muscular fibres. It is lined by mucous membrane.

The *Thyroid* gland is a brownish red body, situated about the second or third tracheal ring, consisting of

two lobes joined by a narrow band. The gland is ductless and secretes an albuminous fluid. It is large in fœtal life, but its use is unknown.

The *Thymus* is another ductless gland, situated on the inferior aspect of the trachea, and above the sternum.

It consists of two lobes united by areolar tissue. In the fœtus it is attached to the thyroid, is large at birth, gradually disappearing.

Bronchi and *Bronchial Tubes*. The terminal branches of the trachea are the right and left bronchi, which enter the lungs and sub-divide into branches, termed bronchial tubes, which redivide until they become very small, and terminate in the air cells. The entire ramification, when isolated, has the appearance of a tree. The right bronchus is larger than the left. The left is longer, as it passes under the aorta before reaching the lung. The bronchi and bronchial tubes are made up of cartilaginous rings, differing only from the trachea in being made up of several pieces, which overlap and are united by cellular tissue on their inner surface. As the tubes diminish in size, the number of these pieces are diminished, and finally disappear. The air cells consist only of the lining membrane of the tubes.

The *Thorax*, or thoracic cavity, is formed by the ribs, sternum and bodies of the dorsal vertebræ, the intercostal muscles and diaphragm. It contains the lungs, the heart and its adjuncts, the trachea, œsophagus and a quantity of nerves.

The *Pleura*. The thorax is lined by two serous membranes, the right and left pleuræ, which consist of parietal and visceral portions and form two distinct sacs. Each pleura lines one-half of the thorax and half of the diaphragm, and covers the lung on that side. The portion of pleura lining the ribs is called *pleura costalis*, that covering the diaphragm, *pleura diaphragmatica*, and that covering the lung *pleura pulmonalis*. In the mesian longitudinal plane, between the lungs, it forms with the opposite pleura, the *mediastinum*, which is divided into three portions. The anterior portion lies in front of the heart, the middle contains it, while the posterior lies behind it. The mediastina contain the trachea, œsophagus, heart,

vessels and nerves. The pleura is thick and loosely attached over the ribs, attenuated over the diaphragm and pericardium, and extremely so over the lungs. Its inner surface is smooth, and secretes a vapoury fluid, which lubricates its surface and facilitates motion.

The *Lungs*, the essential organs of respiration, are spongy organs of a conical shape, situated in the thoracic cavity, right and left, the former being slightly the larger. They are separated by the mediastinum, heart, pericardium and large blood vessels. They are light, porous and highly elastic, possessing considerable strength. Healthy lungs float in water, their buoyancy being due to the air they always contain. The external shape corresponds to the shape of the thoracic cavity. The internal surface, or where the two lungs meet, forms a vertical plane in contact with the mediastinum, and presents an anterior division, which rests against the anterior mediastinum, in front of an excavation in which the heart is lodged. Structurally the lungs consist of an external serous coat, a subserous layer, and the lung tissue proper or *parenchyma*. The serous coat is the pleura pulmonalis. The subserous layer is composed of cellular tissue. The parenchyma is divided into many lobules of various sizes, united by connective tissue. These are again made of smaller ones, each of which is composed of a small bronchial tube and its terminal air cell, in the wall of which are the capillaries which unite the pulmonary arteries with the pulmonary veins. The air cells are vesicular cavities, arranged in bunches at the end of the tube; they consist of a thin membrane of connective and elastic tissue with a layer of pavement epithelium.

Physiology of Respiration.

Respiration is for the purpose of removing impurities from the blood, the chief of which is carbonic acid; and the supplying of oxygen to that fluid, thus rendering it fit to nourish the tissues. It consists of two acts, viz: Inspiration and Expiration; the former is due to the chest being enlarged by contraction of the diaphragm and elevation of the ribs by the muscles.

Expiration succeeds inspiration after a brief interval, and is accomplished by the elastic recoil of the lungs

and walls of the chest, also by the contraction of the abdominal muscles.

The temperature of expired air is variable, but under ordinary circumstances is higher than that of inspired air; when the external temperature is low that of expired air sinks somewhat, when the external temperature is very high the expired air may become cooler than the inspired. The expired air contains 4 or 5 per cent. less oxygen, and about 4 per cent. more carbonic acid than inspired air, the quantity of nitrogen suffering but little change. Besides carbonic acid, expired air contains various impurities, many of an unknown nature. Ammonia has been detected in expired air. When the expired air is condensed by passing into a cool receiver the aqueous product is found to contain organic matter and to rapidly putrefy. The organic substances present in expired air are the cause, in part, of the odour of the breath.

The blood in passing through the lungs is robbed of a portion of its carbonic acid, and loaded with a certain quantity of oxygen. Respiration is an involuntary act, though all the muscles employed are voluntary, and though respiration may be modified to a limited extent by the will, yet we habitually breathe without the intervention of the will. The normal breathing may continue not only after unconsciousness, but even after the removal of all parts of the brain above the medulla oblongata.

Urinary System.

The organs of this system secrete the urine from the blood, and excrete or expel it from the body. These organs are the Kidneys, Ureters, Bladder and Urethra. The urine is secreted by the kidneys, carried by the ureters to the bladder, where it accumulates, and from which it is expelled through the urethra.

The *Kidneys* are two compound tubular glands, situated on the right and and left of the vertebral column in the sublumbar region of the abdomen. They are supported by peritoneum and cellular tissue, by their vessels and by the pressure of the intestines. The right one is in advance of the left, lying just behind the last pair of ribs, while the left is about two inches further back, and is longer and narrower than the right. In shape they some-

what resemble the heart on playing cards. The suprarenal capsule is attached to the anterior border. The internal border of the kidney is slightly concave and deeply notched in its centre, forming the *hilus* which leads to the cavity called the *sinus*. The vessels, nerves, and duct of the kidney join it in, or about, the hilus. The kidney is made up chiefly of the tubes of the gland, *uriniferous tubes*, with blood vessels, nerves and connective tissue. It is invested with a fibrous capsule and contains a cavity called the *pelvis* of the kidney. This capsule invests the entire organ, entering the hilus and covering the sinus, vessels and duct. On making a horizontal section of a kidney we find it to consist of an external or *cortical*, and an internal or *medullary* substance. The cortical portion is a dark reddish brown and friable, consisting of minute blood vessels, convolutions of uriniferous tubes, lymphatics and nerves, united by areolar tissue. On examining a section with a lens red points are seen, called the *Malpighian bodies*. Each consists of capillary blood vessels, arranged in a tuft, surrounded by epithelium, and enclosed in a capsule, the capsule of Bowman, which is the dilated organ of a uriniferous tube. The small branch of the renal artery entering the capsule is the *afferent vessel*, whence proceed the capillaries which form the tuft. The *efferent vessel* leaves the tuft near the afferent one, forming a plexus round the adjacent tubes, terminating in veins.

A dark line separates the cortical from the medullary portion, which is denser in structure, fibrous in appearance, and consists of pale conical masses, the *pyramids of Malpighi*. These are composed of minute, divergin , uriniferous tubes. In the horse they terminate in a continuous ridge, which project into the pelvis, and on these ridges are the *outlets*. Through these outlets the urine passes into the pelvis, a cavity in the centre of the kidney formed by the dilatation of the ureter, which has lateral prolongations called the arms. The function of the kidneys is to secrete the urine, a fluid consisting of water, holding in solution a varying quantity of earthy salts, and a peculiar nitrogenous substance, *urea*, which, if not eliminated, acts as a blood poison.

The *Suprarenal Capsules* are two small, flat, reddish-

brown bodies, attached to the anterior border of the kidneys. They are ductless and their function is unknown.

The *Ureters* are two canals which convey the urine from the pelvis of the kidney to the bladder. On leaving the hilus they are directed towards the pelvic cavity, terminating in the upper and back portion of the bladder which they enter on either side by piercing its coats in an oblique manner, which prevents regurgitation of the urine.

The *Bladder* is a musculo-membranous organ, serving as a reservoir for the urine, situated in the pelvic cavity, and when full projects into the abdomen. It consists of a fundus or body, and a neck. The *fundus* when full is ovid, and turned forward, having a cicatrix, which marks the site of the *urachus*. The *neck* is turned backwards and is continuous with the urethra. It is related above with the rectum in the male, and with the vagina and uterus in the female. The bladder consists of three coats, mucous internal, muscular in the middle, and serous external. The contraction of the walls forces the urine into the urethra.

The *Urethra* is a tube, common, in the male, to the urinary and genital organs, and will be described with the latter.

Generative System.

Animals possess the faculty of reproducing or propagating their species. This function may be sexual or non-sexual, the latter being confined to lowly organized classes of animals. In all the higher animals the generation of a new being depends on two individuals, a male and a female, the female furnishing a germ of ovum, and the male a fluid or sperm, which animates the germ and renders it fit for development. Both the ovum of the female and the sperm of the male are the secretion of glands, called genital glands, and in either sex the generative system may be said to consist of these glands, with certain accessory organs. The act of coition brings the secretions in contact.

Male Genital Organs.

The spermatic or seminal fluid of the male is elaborated in two glands, situated in the scrotum, called the testicles, each being furnished with an excretory duct, the Vas

deferens, which transmits the sperm to the reservoirs, the Vesiculæ Seminales, situated on the bladder. Here the sperm accumulates, and is expelled by the contractile walls of the vesiculæ during the act of copulation, through the ejaculatory ducts into the urethra, which is common to the urinary and genital organs. The urethra is provided with accessories, the prostate and Cowper's glands, and is supported by an erectile tissue which forms an elongated organ, the penis.

The *Scrotum* is a sac, or bag, which contains the testicles, situated between the thighs, and made up externally of a layer of skin. It is marked in the middle by a longitudinal raphe, indicating its division into right and left cavities. Below the skin is a thin layer of muscular and elastic tissue, forming a tunic called the *dartos*, which ends in a fold between the testes called the *septum scroti*.

The *Inguinal Canals* are slit-like apertures in the posterior part of the floor of the abdomen, through which passes the spermatic cord in the male, and the mammary vessels in the female. The external orifice is called the *external inguinal ring*, and the internal orifice the *internal inguinal ring*, and the space between the *inguinal canal*.

The *Spermatic* cord suspends the testicle in the scrotum (one to each testicle). It is made up of the Vas deferens, blood vessels, nerves and serous membrane, muscular tissue and fascia. It extends from the inguinal canal to the testicles, certain coverings being common to it and the latter.

The *Testicles* are two oval glands, situated in the scrotum, attached superiorly to the spermatic cord. In fœtal life they are first situated behind the kidney, and above the peritoneum. At a certain period they descend through the inguinal canals into the scrotum. In their descent each is guided by a soft cord, the *gubernaculum testes*. In their descent they carry with them coverings derived from the abdominal periaties, also coverings composed of peritoneum. The first tunic proper to the testicle is the *tunica albuginea*, which is reflected into its substance, forming a septum called the *mediastinum testes*, from which processes are sent out dividing the testicle into lobes. Inside of this tunic we have the *tunica vasculosa*

enclosing the testicle and giving off vascular processes to it. The testicle is divided into from 200 to 300 distinct lobes, which consist of numerous tubes with cæcal ends, called *tubuli seminiferi*, in which the semen, or sperm, is secreted.

The *Epididymis* is an elongated body extending along the upper border of the testicle. It consists of a body, a head, and a tail. The body is free and curved to the shape of the testicle. The head, situated anteriorly, is adherent to the testicle. It is the largest part and gradually becomes slimmer towards the body. The epididymis is composed of small convoluted tubes, which join and become larger until they form one single tube, the vas deferens.

The *Vas Deferens* is a tube with solid walls, which, after leaving the epididymis, ascends the back part of the spermatic cord to the inguinal canal, where it leaves the cord, enters the pelvis, and passes to the neck of the bladder, where it is joined by the duct of the vesicula seminales, the two forming the ejaculatory duct.

The *Vesiculæ Seminales* are two pear-shaped, glandular pouches, situated on each side of the postero-superior aspect of the bladder, and between it and the rectum. They are receptacles for the semen, and secrete a special fluid which mixes with the semen.

The *ejaculatory ducts* are right and left, formed by the junction of the vas deferentia and the vesiculæ seminales. They terminate in the urethra by two orifices.

The *Uterus Masculinus* represents in the male, the uterus in the female. It is a canal about four inches long, which ascends in the folds of the peritoneum between the vas deferentia. Its lower end is situated between the ejaculatory ducts.

The *Prostrate Gland* is situated around the neck of the bladder and commencement of the urethra. It varies in size, and consists of three lobes, a middle and two lateral. The middle one lies on the neck of the bladder, and in old age sometimes becomes enlarged, and presses on the urethra, causing retention of urine. The secretion is excreted by ducts into the urethra.

Cowpers glands are a pair of small bodies, situated on either side of the membranous portion of the urethra,

above the ischial arch. They resemble the prostrate gland in structure, and terminate in the urethra by a row of minute openings on either side.

The *Urethra* is a tube which extends from the neck of the bladder to the glans penis in the male, and to the vulva in the female. In the latter it is merely an excretory passage for the urine, but in the male it also transmits the seminal fluid.

The *penis* is the male organ of copulation. It contains the greater portion of the urethra. It may be said to consist of an attached and a free portion, the first originating at the ischial arch, and terminating before the brim of the pubis, where the free portion commences. The penis is formed of what is called *erectile tissue*, which, under certain circumstance, becomes enormously distended with blood. The erectile structures are two in number, the *corpus cavernosum* and the *corpus spongiosum*. The corpus cavernosum is much the larger, and forms the superior and lateral portions of the penis. This portion is invested by a strong, elastic, fibrous tissue, which sends out processes dividing the structure into numerous compartments which receive the blood during erection of the organ. The corpus spongiosum encloses the urethra, and is situated in a groove in the inferior portion of the corpus cavernosum. At the anterior extremity it expands to form the *glands*. At the apex of the glands is a deep fossa, in the centre of which lies the *meatus urinarius*

The *Sheath* is a loose fold of integument, which invests the free portion of the penis. It forms a sac extending from the scrotum forward. Anteriorly a loose fold of the sheath projects, covering the anterior extremity of the penis when quiescent ; this is the *prepuce* or foreskin, and from it the skin continues in a modified form over the glans, while it covers and becomes continuous with the mucous membrane of the urethra, The corrugations of the prepuce admit of the erection and protrusion of the penis. Opening on its inner surface are the *glandulæ. odoriæ* which secrete a peculiar odorous matter.

The *Seminal Fluid*. The secretion of the male genitial organs is a viscid, whitish albuminous fluid, the sperm or seminal fluid, which contains the *spermatozoa*, microscopic

objects consisting each of an ovid head and a long wavy tail. They possess a certain vibratory motion, and have the power of penetrating and fertilizing the female ovum.

The *female genital organs* are the *ovaries* which furnish the *ovum* or germ of the future animal. The ovum is conveyed along the *Fallopian tube* to the *uterus*, a cavity in which it becomes impregnated by the sperm of the male, and developed. The vagina is a tube or cavity analogous to the urethra in the male, common to the urinary and genital systems. the uterus opening into it anteriorly and the meatus urinarius being situated at its posterior boundary.

The *Ovaries* being the analogues of the testicles, are the ultimate organs of generation in the female. They are similar in shape, but smaller than the testicles, and are situated in the sublumbar region of the abdomen, a little behind the kidneys, their tunic resembling that of the testicles, is a dense *tunica albuginea.* Within are numerous small bodies, called the *Graafian vesicles*, which contain a fluid in which the true ovum resides. This fluid is secreted by the cells of this vesicle. It increases in quantity as the vesicle develops. During the period of heat or *œstrum* the walls burst, and the fluid with the ovum escapes into the Fallopian tube and is carried to the uterus. The ovum is, in the higher animals, microscopic, being about 1-150 of an inch in diameter.

The *Fallopian Tubes* are two canals which convey the ovum from the ovaries to the uterus. They run in a serpentine route from each uterine horn to the ovary. Each commences in a very minute opening, the *ostium uterinum*, and terminates in a small orifice, the *ostium abdominale*, which communicates with the abdomen. The free extremity of the tube terminates in a series of fringes which are arranged in a circle around the ostium abdominale. One of these fringes is attached to the ovary and along it is a fissure, continuous with the external opening of the tube. The fringes embrace the ovary during sexual excitement, receiving the ovum on rupture of the vesicle and conveying it to the Fallopian tube.

The *Uterus*, or womb, is a musculo-membranous sac situated in the sublumbar region and pelvic cavity. It consists of a *body* and two *horns* The body is cylindrical

and somewhat flat. Its superior surface contacts the rectum, which passes between the horns. The anterior extremity is continuous with the horns, and the posterior with the vagina, constituting the *neck*, which is thick and round, and projects into the vagina in the virgin animal; in its centre is a canal, the *os uteri*, leading into the body. The horns spring from the anterior extremity of the body, diverge upwards and forwards, communicating with the Fallopian tube. The uterus consists of three coats, an external serous, middle muscular and an internal mucous. The serous coat is a reflection of the peritoneum, it forms the broad ligament which suspends the uterus.

The *Vagina* is a canal leading from the uterus to the vulva. It is wide and surrounds the neck of the uterus, but is constricted at the vulva. It is the chief female organ of coition.

The *Vulva* is the external orifice of the urino-genitial system, is situated below the anus, appears as a long ovoid slit, presenting two lips and two commissures. The lips have an external covering of soft skin, and an inner one of mucous membrane. Between these is a quantity of fat and areolar tissue, and some erectile tissue. This structure is charged with blood during copulation, rendering coaptation very complete. In a depression on the floor lies the *clitoris*, which is composed of erectile tissue and becomes erect during copulation. The external orifice of the urethra, the meatus urinaries, open on the inferior surface of the vulva, about four inches from the external opening. It is larger than the male opening, and is surrounded by a fold of mucous membrane, which acts as a valve.

The *Hymen* is a thin semi lunar fold of mucous membrane, which imperfectly separates the vulva from the vagina, lying immediately before the meatus. It is ruptured during the first act of copulation.

From the above descriptions it will be apparent that in the male animals the female organs are indicated, as are the male organs in the female. Thus in the male the uterus masculinis represents an undeveloped uterus, and in the female the clitoris, a rudimentary penis. This points to the fact that in early fœtal life there is no

distinction of sex, each animal having rudimentary male and female generative organs. Should both systems of organs in the same animal become more or less developed, but neither of them perfectly so, the animal is said to be *hermaphrodite*.

The *Mammary Glands* in the young female, as in the male, are rudimentary, becoming developed in the former at puberty, or when the animal is fit for reproduction. In the mare these glands are two in number. In full activity they present two hemispherical masses, separated by a shallow fissure, each half presenting in its centre a nipple, or *teat*, pierced at its free extremity by numerous orifices for the passage of milk. The interior of the gland is made up of yellow glandular tissue, consisting of numerous lobes united by a cellular tissue; each of these is again made up of small lobules composed of minute ducts and numerous small cells, in which the milk is secreted, and conveyed to the ducts, which unite to form a common excretory duct for each lobe. These ducts converge to the centre of the gland where they terminate in dilated cavities, the *lactiferous sinuses* which communicate with each other. From these proceed a number of canals which run to the free extremity of the teat by constricted orifices. The mucous membrane of the teat is surrounded by muscular fibre, which acts involuntarily as a sphincter and retain the milk. The base of the teat is surrounded by certain glands secreting a lubricating fluid which protects the teat during the sucking of the young, and prevents the plugging of the orifices by coagulation of the milk.

Comparative Anatomy.

We will now briefly consider the four systems we have been studying, and note the principal differences between the anatomy of the horse and ruminants.

The lips of the ox are thick and only indirectly prehensible. The centre of the upper lip is devoid of hair and constitutes the muzzle, and in health is always moist. The lips of smaller animals are thin, very mobile, and are agents of prehension. The cheeks of ruminants present on their inner surface conical papillæ which point backwards. The soft palate is not so complete and pendulous

as in the horse, thus permitting the animal to breathe through the mouth and allowing the upward passage of food. The tongue of the ox is prehensible, and is rougher, shorter and thicker than in the horse, and pointed at the tip. The ox and sheep have no incisor teeth in the upper jaw, but instead have a thick cartilaginous pad with which the lower incisors come in contact in cropping grass, etc. The incisors are eight in number in the lower jaw, and have a certain degree of mobility which prevents injury to the pad. The œsophagus is well developed, and its muscular walls are red throughout, and join the stomach by expanding. The muscular fibres induce both a downward, or a peristaltic, and an upward, or anti-peristaltic, motion.

The *Stomach* of ruminants is a very complex organ, consisting of four compartments, which vary in size and form, and in the disposition of their mucous coat. The first is the *rumen*, or paunch, the second the *reticulum*, or honey-comb, the third the *omasum* or many plies, and the fourth the *abomasum* or true digestive stomach. The first three are principally concerned in preparing the food for the fourth, and have little to do with the essential process of digestion. The *rumen* is very large, occupying about three-quarters of the abdomen. It is situated on the left side. The surface is smooth and divided into two lateral regions by a groove. The anterior extremity receives the insertion of the œsophagus, and is continuous with the second compartment, and is bounded anteriorly by the second and third, and the diaphragm. The posterior occupies the entrance of the pelvic cavity, where it contacts the urino-genital organs. In the female the uterus is prolonged over its surface. The superior surface is related with the intestines, while the inferior rests upon the floor of the abdomen. The left side, to which the spleen is attached, is in contact with the abdominal walls in the lumbar region. The interior is incompletely divided into four sacs by fleshy pillars. The mucous coat is cuticular, papillated, and covered by thick epithelium. The *reticulum* is the smallest of the four, and is situated between the diaphragm and the rumen. The internal surface is divided into polyhedral cells by folds of mucous membrane. It communicates with the rumen, the œsophagus and the omasum. The

communication with the latter two is by the œsophageal canal, a continuation of the œsophagus, which commences at the cardiac orifice, passes along the roof of the reticulum and enters the omasum by a circular opening. Its sides consists of two movable lips, which are continuous with the muscular walls of the œsophagus, and are attached by one border to the superior wall of the reticulum, the other being free. There are transverse and longitudinal fibres in the muscular coat of this canal. The longitudinal fibres by contracting draw the lips together, forming a channel leading from the œsophagus to the omasum, thus effectively closing the opening into the rumen and reticulum.

The *Omasum* is also situated between the diaphragm and the rumen, and when full is ovoid. The left extremity is constricted, forming the neck, by which it communicates with the reticulum. The interior is filled with leaves, or folds of mucous membrane, which follow the long axis of the organ. Between each pair of large we have small leaves, which extend a limited distance only. They consist of an inner framework of muscular fibres, clothed with mucous membrane, studded with papillæ, some of which are small, others large and bent, the latter retaining crude portions of food for further trituration and maceration, while fluids and finer portions pass directly to the abomasum.

The *Abomasum*, or the digestive stomach, is continuous with the omasum and duodenum; from the latter it is separated by the pyloric ring. The interior resembles the villous portion of the stomach of the horse, having glands and follicles which secrete gastric juice.

The process of rumination is believed to be effected as follows: The food being swallowed falls into the rumen, where it is tossed about by the muscular action and saturated with fluid, a portion is thrown through the valvular opening into the reticulum, and gains a further supply of fluid, and the finer particles are separated from the coarser, the former proceed to the omasum, the latter, by the muscular contraction of the reticulum, the relaxation of the œsophageal pillars and the anti-peristaltic action of the œsophageal walls, is returned to the mouth to be remasticated, and once more swallowed. Any coarse portion again falls into the rumen to be reacted

on, the remainder passes down the œsophageal canal to the omasum, whence liquids flow into the abomasum, while solids are drawn between the leaves of the omasum to be further prepared.

The *small intestine* differs little from that of the horse, except that it is smaller in calibre, but on an average twice the length. There is no distinct separation between the great and floating colon as in the horse. The total length of the large intestine in the ox from the cæcum to the rectum is 36 feet, but its capacity is much less than that of the horse.

The *Liver* of the ox is very thick, and is provided with a pear-shaped gall bladder lying upon its posterior surface. The duct of the gall bladder enters the duodenum singly, not connecting with that of the pancreas, as in the horse.

Respiratory System.

There are not many important differences. We may note the presence of a third bronchus which passes to the right lung to supply a lobe which is wanting in the horse. The left lung is divided into two lobes, the right into four. The interlobular cellular tissue is exceedingly thick, the separation between the lobules being distinctly visible.

The Urinary System.

The kidneys of the ox are more or less lobulated, somewhat resembling a bunch of grapes.

The Genital System.

Male Organs.

The testicle is ovoid and well-developed, the vasa deferentia join and form one common duct. The urethra gradually diminishes in calibre from its origin, its most prominent feature is, that just before the pubis it describes a double curve on itself something like the letter "S." The prostate gland is small. Cowper's glands are wanting.

The *Penis* is long and thin and projects far under the abdomen; like the urethra it is bent upon itself forming the letter "S," which becomes straight when erected. The sheath extends much further forward than in the horse.

Female Organs.

In the female the ovaries are comparatively small. The uterus presents generally the typical arrangement, but the mucous membrane presents a number of rounded vascular processes which exhibit eminences and depressions, these are termed *maternal cotyledons* and their function is a fœtal one. The mammary glands in the cow constitute an organ called the udder, which is composed of two symmetrical halves placed one against the other. Each half is again divided into two distinct glands, each with its own teat, so that the udder consists of four mammæ and four teats; behind these there may be two rudimentary teats. There is but one excretory channel in each teat.

In the small ruminants there are two mammæ and two teats constructed like those of the cow.

Angiology.

Under this head we describe the organs of circulation, by the action of which certain fluids are propelled through the body. We will divide it into two sections, the Blood-Vascular and Lymphatic systems.

The Blood-Vascular System.

This involves the Blood, Heart, Arteries, Veins and Capillaries.

The *Blood* is a fluid which nourishes all living structures, being the medium by which nutritive material is conveyed to, and effete material conveyed from the solid tissues. Its colour varies in different parts of the same animal, that in the arteries being bright red or scarlet, while that in the veins is of a dark purplish hue. Microscopically examined it is found to consist of minute corpuscles, and a clear, yellow fluid, " the *liquor sanguinis*," in which the corpuscles float. The corpuscles are of two kinds, the red and the white, the former are much more numerous and vary in shape. In mammals they are more or less discoid and bi-concave, their average diameter being one-four-thousandth part of an inch, and thickness one quarter of this. The *white corpuscles* are larger, round and nucleated. The *liquor sanguinis* is pale and clear, and consists of water, fibrin, albumen, fatty compounds odoriferous and saline matters. The *serum* consists

of liquor sanguinis deprived of fibrin. It contains 90 per cent. of water and coagulates when heated, owing to albumen. Fibrin is a white, stringy, elastic substance which is in solution in circulating blood and cannot be distinguished from other constituents of liquor sanguinis.

The *Heart* is a hollow, involuntary, muscular organ, situated between the layers of the middle mediastinum, and in the pericardial sac. Its form is that of a blunt cone slightly flattened from side to side, and it presents a base and an apex. The base is turned upwards and towards the dorsal vertebræ, from which the heart is suspended by the blood vessels. The apex points downwards, backwards, and to the left side, lying at about the level of the last bone of the sternum. The organ extends from about the third to the sixth rib inclusive. The average weight of a horse's heart is about six and a half pounds, its length about eight inches, its antero-posterior diameter rather less, its lateral diameter less still. The heart is divided by a longitudinal septum into a right and left side. Each of these is again subdivided by a transverse septum into two compartments which communicate. Thus there are four cardiac cavities, the superior ones, whose free extremities somewhat resemble a dog's ears, are called the *auricles*, the inferior ones, the *ventricles*. These divisions are marked externally by deep grooves, in which the cardiac blood vessels run and which are usually filled with fat. Two of these grooves extend from the base of the ventricles to the apex, and are called the anterior and posterior longitudinal furrows. Around the base of the ventricles is a deep transverse auriculo-ventricular furrow which marks the division of the heart into an upper or auricular and a lower or ventricular portion. The right side of the heart is sometimes called the *venous* and the left the *arterial* side. We will first consider the cavities of the right and then those of the left.

The *Right Auricle* is the larger and forms the right and anterior portion of the base. It presents two cavities, the *sinus venosus* and *auricular appendix*. The former, the principal cavity, has thin walls and is connected inferiorly with the right ventricle, internally with the left auricle, and prolonged anteriorly to form the appendix, a small conical pouch with thick wall and serrated edges.

On laying open the auricle we notice the smooth, transparent Endocardium, or lining membrane, the anterior and posterior Vena-cavæ, Coronary sinus, Foramina Thebesii and the right Auricular Ventricular opening. The anterior Vena-cava opens into the supero-posterior part of the sinus venosus. The posterior Vena-cava opens into the infero-posterior part of the external wall of the sinus. The Coronary sinus is below the opening of the posterior Vena-cava ; through it the blood is returned from the substance of the heart ; the coronary valve covers the opening. The Foramina Thebesii are minute openings on the inner surface of the auricle, being the openings of small veins which return the blood directly from the walls of the heart. The right Auriculo-ventricular opening is large and oval, occupying the floor of the auricle and communicating with the right ventricle. On the Auricular septum is a depression, the *fossa ovalis,* the remains of the foramen ovale. There are columns of muscular fibres chiefly in the appendix called *musculi pectinati,* from their resemblance to the teeth of a comb.

The *Right Ventricle* occupies the antero-inferior part of the right side of the heart. Its walls are thicker than those of the auricle but thinner than those of the left ventricle. On laying the cavity open two openings are seen. The *auriculo-ventricular* communicating with the auricle, is surrounded by the auriculo-ventricular ring, and guarded by the tricuspid valve, which is formed by a doubling of the lining membrane, strengthened by fibrous tissue. It consists of three triangular segments, which, connected at their bases, surround the opening. The edges are thick, and to their ventricular surfaces are attached a number of tendinous cords, the *chordæ tendineæ,* which spring from the the *musculi-papillaries* and the inner surface of the ventricle. The valve prevents regurgitation of blood into the auricle when the ventricle contracts. The second opening is the origin of the *pulmonary artery.* It is above and to the left of the auriculo-ventricular opening, and is guarded by three *semi-lunar* or *segmoid* valves, which consist of folds of lining membrane, and are attached by their convex margins to the tendinous ring which surrounds the opening. Their free edges are nearly straight and thinner than

their attached ones. When blood passes from the ventricle to the pulmonary artery the valves are placed against the sides of the vessels; when the current is checked a portion of it falls back towards the ventricle, and the valves are thrown inwards and completely close the tube. Behind the valves, at the commencement of the artery, are three dilations or pouches, bounded below by the valves themselves, and called the *sinuses of Valsalva*. From the inner surface of the ventricular walls project the fleshy columns, or *Carneæ Columnæ*, which form a network from which the chordæ tendineæ spring.

The Left Auricle is smaller than the right, but its walls are thicker. It is situated at the left postero-superior part of the heart and consists of a *sinus* and an *appendix*. On laying open the cavity we find the openings of the *pulmonary* veins, usually two pairs, one pair on the right and the other on the left of the sinus; they are not guarded by valves. On the floor is the *auriculo-ventricular* opening communicating with the *left* ventricle.

The *Left Ventricle* is larger, rounder, and more prominent than the right, projecting lower and forming the apex. Its external wall is thicker than that of the right. On laying open the cavity two openings are seen, the left *auriculo-ventricular* opening and the *aortic*. The former is guarded by the *bicuspid* or *mitral valves*. The valves have the same general characters as the *tricuspid*. The aortic opening is deeply seated in the supero-anterior part of the ventricle, a little to the right of the auriculo-ventricular opening, from which it is separated by one of the segments of the mitral valve. It is guarded by three semi-lunar valves similar to those of the right side, but stronger. The rest of the inner surface has the same general characters as the right side.

The *Structure of the Heart* consists of a fibrous framework, muscular and connective tissue, vessels and nerves, the whole being covered by one, and the cavities lined by another serous membrane.

The mass of the heart is composed of muscular fibres connected by areolar tissue. The fibres are involuntary, and of a deep red colour, differing from other involuntary muscles (the œsophagus excepted), in being transversely and longitudinally striated. They are smaller than voluntary fibres and are anastomatic.

The muscular fibres are attached to a framework which consists of fibro-cartilaginous rings surrounding the auriculo-ventricular and arterial openings. Between the aortic ring and the auriculo-ventricular openings is a fibro-cartilaginous mass which in the ox is replaced by a bone, the os cordis.

The *Endocardium* is the name given to the serous membrane which lines the cavities of the heart. It is continuous with the lining membrane of the blood vessels.

The *Pericardium* is a fibro-serous sac which encloses and is reflected over the heart and origins of the large blood vessels. It is composed of two layers, an external fibrous and an internal serous. The serous secretes a pale, lubricating fluid, the liquor pericardii

Course of the Circulation. The venous blood is carried into the right auricle by the anterior and posterior venacavæ, passes through the right auriculo-ventricular opening into the right ventricle, thence through the pulmonary artery to the lungs. It returns through the pulmonary veins to the left auricle, passes through the left auriculo-ventricular opening to the left ventricle, which propels it through the aorta and its branches into the system generally, the veins returning it again to the heart. The circulation therefore is double; the pulmonary, or lesser, being performed by the right side; and the Somatic, or greater, by the left side of the heart.

The *Arteries* are tubes conveying the blood from the heart, a series belonging to each circulation. Both arteries leave the heart by a single trunk which subdivides and terminates in capillaries whence the veins originate. The large arteries are usually deep-seated, occupying the cavities of the trunk and inner surfaces of the limbs, where they are less exposed to injury. When they pass over an articulation they are usually found on the flexor side. Arteries freely communicate with each other, forming what are called anastomoses. Arteries are dense and elastic, possessing great power of resistance. Their walls consist of three tunics, an external, middle, and internal. The internal, or serous, is thinnest; the middle tunic is contractile, elastic, dense, and of a yellow colour, consisting of non-striated muscular tissue and elastic fibre; the external coat is made up of areolar tissue and elastic

fibres. The arterial sheaths consist of cellular tissue intimately connected with the surrounding textures. An artery is usually accompanied by a vein and nerve, all of which may lie in the same sheath, the vein being more superficial. The coats of arteries are supplied with nutrient blood vessels, the vasa vasorum, which come from neighbouring vessels. The external coat is very tough, while the middle and internal ones are elastic and brittle; on ligaturing an artery the middle and internal coats give way, while the external remains intact.

The *Capillaries* are interposed between the termination of arteries and the commencement of veins, forming plexuses which vary much in arrangement. Their average diameter is about one three-thousandth of an inch, varying in different textures, smallest in the brain and mucous membrane of the intestines, largest in the skin, in glands, and the interior of bones. All arteries do not terminate in capillaries, an exception being in the erectile tissue, where they end in cells or cavities placed at the origin of the veins.

The *Pulmonary Artery* springs from the right ventricle, curves upwards and backwards, and divides into right and left branches, which penetrate the substance of their respective lungs, along with the bronchii, ramifying in the lung along with the bronchial tubes and terminating in capillaries, which form a dense network on the walls of the air cells, the branches belonging to different lobules do not anastomose; from these capillaries spring the radicles of the pulmonary veins. The pulmonary is the only artery in the adult that conveys venous blood.

The *Common Aorta* is the main trunk of the arterial system. It arises from the left ventricle, passes upwards and forwards for about two inches, then divides into anterior and posterior aortæ, the former supplying the fore extremity, neck and head, and the latter the rest of the body and limbs.

Coronary Arteries.—In addition to its terminal branches, the aorta gives off right and left coronary or cardiac arteries, which nourish the tissues of the heart.

The *Posterior Aorta* is larger and longer than the anterior. It commences about the level of the fourth dorsal vertebra,

passes upwards and backwards, forming the aortic arch, reaches the left side of the spine at the sixth or seventh dorsal vertebra. It passes straight backwards through the hiatus aorticus to the abdomen, and terminates at the posterior part of the sublumbar region by dividing into external and internal iliacs. It is divided into thoracic and abdominal portions. It furnishes parietal and visceral branches.

Parietal Branches.

Aortic Intercostals	Phrenic
Lumbar	Middle Sacral

The *Intercostals* are doublets, 17 in number, the last 13 of which arise directly from the posterior aorta (the first arises from the superior cervical and the next three from the dorsal artery). The intercostals, after leaving the trunk, skirt the dorsal vertebra, and divide into inferior or intercostals and superior or dorso-spinals. The former branch is the larger, and travels along the grooved posterior border of the rib down the side of the thorax, and supplies the pleura, intercostal and thoracic muscles, The dorso-spinal branch is distributed to the dorsal muscles and integument, and supplies the cord and its coverings.

The *Lumbar* arteries, five or six pairs, originate like the intercostal and divide into *superior* or lumbo-spinal, which supply the muscles of the loins, and send branches to the cord, and *inferior* which supplies the abdominal muscles. The *Phrenic* supplies the diaphragm. The *middle sacral* is a mesian continuation of the posterior aorta, often absent in the horse.

Visceral Branches.

Broncho-Œsophageal—Thoracic.

Cœliac Axis,
Great Mesenteric,
Small Mesenteric,
Renal,
Spermatic,
Small Testicular, } Abdominal.

The *Bronchial* supply the lungs, the *œsophageal* the *œsophagus*.

The *Cœliac axis* arises from the lower surface of the aorta as it enters the abdomen ; is about an inch long, and divides into Gastric, Splenic and Hepatic. The gastric is distributed to the stomach ; the splenic to the spleen, and the hepatic to the liver, pancreas, and pyloric end of the stomach.

The *Great Mesenteric* arises a little behind the cœliac axis and splits into right, left and anterior divisions. It is distributed to the mesentery ; from it twigs proceed to the small intestine and to a portion of the large.

The *Small Mesenteric* artery arises three or four inches behind the great mesenteric. It supplies the floating colon and rectum.

The *Renal* arteries are right and left, leave the aorta at right angles, and pass straight to the hilus of the kidney ; an anterior branch supplies the suprarenal capsule.

The *Spermatic* arteries, right and left, become, in the female, the *utero-ovarian.* Their diameters considered they are the longest arteries in the body, and they give off no lateral branches, pass through the inguinal canal down the anterior border of the spermatic cord.

The *Utero-Ovarian* arteries supply, in the female, the uterus and ovaries.

The *Small Testicular*, or artery of the cord, is small, passes through the inguinal canal, and supplies the tissues of the cord, first giving branches to the ureter, vas deferens and peritoneum.

The *Posterior Aorta*, at the level of the last lumbar vertebra, gives off the external Iliac arteries, and a little posterior to this the rest of the trunk bifurcates, forming the internal Iliac arteries, which are short, thick trunks. They supply the pelvic viscera, and partially the muscles of the hindquarters.

The *External Iliac* arteries arise below the last lumbar vertebra, curving obliquely outwards and downwards. At the level of the ileo-pectineal line it becomes the *femoral.* The external Iliac gives off the *circumflex ilii.* The *Femoral* is the artery of the thigh. It runs to the inferior part of the off femor, becoming the *Popliteal.* In its course it gives off various branches which supply the

muscles of the thigh. The Popliteal passes under the popliteal muscle, and at the upper part of the tibia bifurcates into *anterior* and *posterior Tibial*. The posterior tibial passes down the posterior part of the tibia to the hock, to which it gives branches, and then divides into internal and *external Plantar*, each of which clings to its own side of the deep flexor tendons, passing down to the fetlock. The *anterior tibial* passes down to the hock, where it becomes the *Metatarsal*, and passes down to the fetlock and joins the plantar arteries, from which proceed the arteries of the foot.

The *Anterior Aorta* is rather more than an inch in length and passes obliquely upwards and forwards ; it divides into right and left arteria innominata, or brachial arteries.

The *Brachial* arteries separate at an acute angle, and pursue a diverging course towards the anterior aperture of the thorax, whence they proceed to the limbs, winding round the first ribs, the right one, being the largest, gives off the *common carotid*. The following arteries are given off alike by both brachial arteries :—the Dorsal, Superior Cervical, Vertebral, Internal Thoracic, External Thoracic, Inferior Cervical, Prescapular and Subscapular, each of which supplies the region its name indicates. When the brachial reaches the humerus it assumes the name of the *humeral* artery and descends along the inner side of the humerus to the elbow joint, just below which it becomes the *posterior radial* artery, having in the meantime given off the *anterior radial* and a number of small branches. It passes down the inner side of the forearm and divides at the distal end of the radius into large and small *metacarpals*. It can be felt just behind the insertion of the flexor brachi. The *large metacarpal* is the true continuation of the posterior radial, and it descends along with the flexor tendons to just above the fetlock, where it divides into the *external* and *internal digital* arteries.

The *Common Carotid* artery is given off by the right brachial. On reaching the anterior opening of the thorax, it divides into *right* and *left carotids* which pass up the neck, one on each side of the trachea, to a level with the larynx, giving off several branches in their course. At the larynx each terminates in a trifurcation forming the following

arteries: The Occipital, Internal Carotid and External Carotid. The *occipital* ascends and passes through the anterior foramen of the atlas, supplying the muscles of the poll, and sending a branch into the spinal canal, joins with its fellow of the opposite side, forming the *bassilar*, which passss along the base of the brain. The *internal carotid* passes through the foramen lacerum basis cranii and is distributed to the brain. The *external carotid* is the continuation of the carotid itself and it supplies the muscles of the mouth, face, ears and eyes.

Veins are vessels which return the blood to the heart, and they consist of two sets, the pulmonary, which convey arterial blood from the lungs to the left, and the systemic, which convey venous blood from the somatic capillaries to the right auricle. They are larger and more numerous than the arteries. The smallest commence at the capillaries, and converge to form larger ones, terminating in trunks which enter the heart. They are *superficial* and *deep*. The former lie immediately beneath the skin, and are mostly unaccompanied by arteries. The latter are situated deeply, and usually related with arteries, and hence are called *satellite veins*. Two veins sometimes accompany one central artery. Veins anastomose more freely than arteries. In the head they form dilated pouches or sinuses, and they form plexuses in the palate and foot. Their coats are thinner but stronger than those of arteries, and collapse when empty. They have three tunics arranged like those of arteries. The majority of veins are provided with *valves*, somewhat similar to the semi-lunar ones at the origins of the great arteries, being a fold of the lining membrane, and their use is to prevent a reflux of blood when the flow is interrupted. They are absent in the pulmonary, cranial, spinal, pedal and osseus veins and vena cavæ. Veins may originate from arteries without the intervention of capillaries, as in the erectile tissues of the penis.

The *Pulmonary veins* return the blood from the lungs to the left auricle. They converge to form four trunks, which enter the auricle by four openings. These are the only veins which convey arterial blood.

The *Posterior Vena Cava* corresponds to the posterior aorta. It commences at the entrance of the pelvic cavity,

formed by the union of the common iliac veins, which are formed by the union of the internal and external iliac veins, which return the blood from posterior extremities and hinder part of trunk. It runs forward under the lumbar vertebræ; on reaching the superior border of the liver it inclines downwards, occupies the anterior fissure of the liver, passes through the foramen dextrum into the thoracic cavity, through a notch in the right lung, and enters the right auricle of the heart.

The *Portal Vein* collects the blood from the visceral organs of digestion; it commences in the sublumbar regions by the union of three large branches, is directed forwards, passes through the pancreatic ring, reaches the liver, enters the gland at the posterior fissure, and is distributed like an artery, terminating in the hepatic veins, which, leaving the liver at the anterior fissure, enter the cava by minute oblique openings.

The *Anterior Vena Cava* returns the blood from the head, neck and fore extremities and part of the thorax. It is formed between the first pair of ribs by the union of the two jugular and two brachial veins, receiving the internal thoracic, vertebral, superior cervical, dorsal and the great vena azygos. The *brachial vein* receives the blood from the anterior extremity. The *jugular vein*, the great vein of the head and satellite of the carotid artery, commences by two branches, its origin corresponding to the breaking up of the external carotid artery. It passes down the neck, superficially placed, occupying the *jugular gutter*, a canal formed by the levator humeri and sterno-maxillaris muscles, it enters the thorax and joins its fellow.

The *Lymphatic* or *Absorbent* system is connected with the blood vascular system, and consists of a series of glands and tubes which absorb and convey to the blood certain fluids, a number of glandular bodies, through which the tubes frequently pass, and the fluids themselves, which are *lymph* and *chyle*. These are called lymphatic vessels because they convey a limpid fluid, clear and transparent; or absorbent vessels because they absorb alimentary matters. The absorbents of the chyle are called *lacteals* or *chyliferous* vessels, but they do not differ in character, or anatomical structure, from the others.

The lymphatics unite to form two large trunks, the *thoracic duct* and the *right lymphatic vein*, both of which enter the venous system near the heart. Delicate in structure, and transparent, they are present in nearly every tissue, and although more numerous than the blood vessels their capacity is probably not greater. The walls of the larger vessels consist of three coats. The coat of the smaller vessels, *lymph capillaries*, consists of membranous and cellular layers. The lymphatic vessels are beaded in appearance, due to valves in their interior which aid the onward flow of their contents; they may pass through two or more glands, or may enter the central trunk without approaching any gland. The *lymphatic glands* are small, round or oval in shape, varying in size from a hemp seed to a kidney bean, and are of a pale red colour.

Lymph is a colourless fluid, containing a number of objects which resemble the white corpuscles of the blood. These are lymph corpuscles, and they are thought to be formed in the lymphatic glands.

Chyle is a milky fluid found in the lacteals or lymphatic vessels of the intestines during digestion. It contains corpuscles similar to those of the lymph. Since both the lacteal and posterior lymphatic vessels lead to the great lymphatic trunk or thoracic duct, it follows that the lymph and the chyle become mixed.

The *Thoracic duct* is the largest and longest lymphatic vessel. It receives all the others, except those of the right anterior extremity, and the right side of the head, neck and thorax. It originates in the lumbar region by a very irregular dilatation, called the *receptaculum chyli*, into which flow the contents of the neighbouring vessels. From the anterior aspect of this reservoir the duct proceeds forward on the right side of the vertebræ, enters the thoracic cavity through the hiatus aorticus, passes along the vertebræ until it reaches about the sixth dorsal, where it curves downwards to the left side over the base of the heart, terminating in the jugular confluent about the anterior border of the first rib. The orifice is guarded by a valve which prevents the influx of blood. The lymphatics which form the affluents of the thoracic duct may be divided into five groups, comprised within the

following divisions of the body, viz.: Posterior region, Digestive viscera, Thoracic viscera, Thoracic walls, Anterior region.

The *Lymphatic vein* is the second principal trunk. It is situated near the junction of the jugular veins, and terminates in their confluent. It receives the vessels from the right anterior extremity, and the right side of the head, neck and thorax. Its opening into the confluent is also guarded by a valve.

The lymphatics of the posterior region are divided into the following groups; Sublumbar, Inguinal (deep and superficial), Popliteal, Iliac and Precural.

Digestive viscera is divided into the Lymphatics of rectum and floating colon, of large colon, of cæcum, of small intestines, of stomach, of spleen and of liver.

Thoracic viscera to the viscera of the thorax.

Thoracic walls into those of the walls and the diaphragm.

Anterior region into Prepectoral, Guttural, Submaxillary, Prescapular and Brachial.

Neurology.

The nervous system includes those organs which may be regarded as receiving and interpreting impression, and regulating the vital functions. It is divided into two minor systems: the *Cerebro-Spinal*, which is to a considerable extent influenced by the will of the animal, and the *Sympathetic* or *ganglionic* system, which comprises the nerves of organic life, and are not directly influenced by the will. Each of these has its own central and peripheral organs. In the first the centre is made up of two portions, one large and expanded, the *brain*, or encephalon, which occupies the cranial cavity; and the other, the *spinal cord*, is elongated and continuous with the brain, being lodged in the canal of the vertebral column. The communicating portion of this system consists of the cerebro-spinal nerves, which leave the axis in symmetrical pairs, and are distributed to the voluntary muscles, and the organs of common sensation and special sense.

In the second system the central organ consists of a chain of ganglia connected by a nerve cord, which extends

from the head to the coccyx, on each side of the spine. The nerves of this system are distributed to the involuntary muscles, mucous membranes, viscera and blood vessels. The two systems have free intercommunication, ganglia being placed at the junctions.

Nervous Tissue is composed of two substances, distinguishable by their colour, viz.: the *white* and the *grey* matter, and when examined by the microscope two distinct structures, *fibres* and *cells* are found. The *fibres* convey impressions to the centres, and transmit stimula from the centres to the various organs. Those which convey impressions are termed *sensory nerves*, and those which transmit stimuli to the muscles are called *motor nerves*, those to the coats of blood vessels *vasa motor*. The *cells* are found chiefly in the nerve centres and they germinate nervous force. This reflection of nervous impulse from one nerve to another is known as *reflex action*.

The centre of the cerebro-spinal system is the cerebro-spinal axis, consisting of the brain and spinal cord, which, with their coverings or meninges are continuous with one another.

Meninges of the Spinal Cord.

The *cerebro-spinal axis* is invested by three distinct membranes, viz.: the *dura mater* externally, the *arachnoid* in the middle, and the *pia mater* internally. The *dura mater* is a strong inelastic membrane. It extends from the foramen magnum, to which it is attached, and is continuous with the dura mater of the brain, to the posterior extremity of the neural canal, where, as a slender cord, it blends with the periosteum of the first bone of the coccyx. It is loosely attached to the inner surface of the canal by a layer of areolar tissue and blood vessels.

The *Arachnoid*, so-called from its resemblance to a spider's web, is a delicate serous membrane, and, like other serous membranes, is a closed sac. It loosely envelopes the pia mater, leaving between them an interval, the *sub-arachnoidean* space, which contains the limpid cerebro-spinal fluid.

The *Pia mater*, the inner envelope of the cord, is a thin vascular membrane, composed of areolar tissue

containing blood vessels. It closely invests the whole surface of the cord, sends processes into its longitudinal fissures, and forms a sheath for the spinal nerves.

The *spinal cord* is a large, white, *irregularly* cylindrical cord, which extends from the foramen magnum to the sacral portion of the neural canal, where it terminates in a slender filament. It is loosely suspended in the canal to allow motion. It varies in size; is dilated at its origin, where it joins the medulla oblongata, and also between the fifth cervical and second dorsal vertebræ, where the large nerves which form the brachial plexus are given off, and again at and posterior to the third lumbar, where the lumbar and sacral nerves which constitute the lumbar-sacral plexus arise. The cord is divided into two-lateral columns by *longitudinal fissures*, superior and inferior. Each side is again divided conventionally into three parts by *lateral fissures*, a superior corresponding with the sensory, and an inferior with the motor roots of the spinal nerves. A transverse section of the cord shows the white matter externally in the form of two *semi-cylinders*, and the grey matter in the centre of each.

The grey substance presents the appearance of two crescentric shaped masses united in the middle by the grey commissure. Each crescent presents two cornua or horns. In the middle of the grey commissure the central spinal canal runs the whole length of the cord, being continuous anteriorly with the fourth ventricle of the brain.

The proportionate size of the brain and spinal cord varies in different animals, according to the position which they occupy in the scale of intelligence. The higher that position the larger and heavier proportionately is the brain, and the smaller and lighter the cord relatively. Thus in man the brain averages 50 oz. and the spinal cord $1\frac{1}{2}$ oz., a proportion of 1 to 33. In the horse the brain averages about 23 oz. and the cord $10\frac{1}{2}$ oz., a proportion of 1 to 2-19.

The *Encephalon*, or brain, is that part of the cerebro-spinal axis situated within the cranium. In form it is a slightly flattened and elongated ovid body, which may be considered as consisting of four parts, viz.: the medulla oblongata, the pons Varolii, the cerebellum and the cerebrum. It has coverings like the cord.

The *medulla oblongata* is the prolongation of the spinal cord, extending to the Pons Varolii, from which it is separated by a narrow fissure. It is pyramidal in shape, the narrowest part being continuous with the cord.

The *Pons Varolii* is a transverse projection on the base of the brain between the medulla oblongata and the crura of the cerebrum.

The *Cerebellum, or* lesser brain, is lodged in the posterior part of the cranial cavity, immediately above the medulla oblongata.

The *Cerebrum*, or great brain, occupies the anterior portion of the cranium. It consists of lateral halves separated by the longitudinal fissure. Deep sulci map out the surface of the hemispheres into numerous convolutions, the number of which and the depth of the sulci indicate the range of intelligence possessed by the animal, as the grey matter, which is believed to be the seat of the intellectual faculties, is found on the surface of the convolutions, and on the sides and bottom of the sulci, so that the deeper and more numerous these are the greater is the amount of grey matter in the brain.

Functions of Different Divisions of the Brain.

The *Medulla oblongata* is the conductor of impressions. The majority of centres for the various organic functions are situated in it, as the Respiratory centre, Convulsive centre, Diatetic centre, centre for Deglutition, Vomiting centre, etc.

The *Pons Varolii* is intimately connected with the co-ordination of the movements.

The *Cerebellum* regulates and co-ordinates the muscular movements of the body.

The *Cerebrum* is the organ of intellectual action, emotion and volition.

Cranial Nerves.

The nerves which are transmitted through the foramina at the base of the cranium, are called *cranial nerves*. They leave in pairs regularly disposed, one on the right and one on the left side, and are named numerically, according to the order in which they leave the cavity,

and by names derived from the parts to which they are distributed, or the functions they perform. There are 12 pairs.

1st.—The *Olfactory*, or nerve of special sense of smell, is distributed to the mucous membrane of the posterior part of the nasal fossa.

2nd.—The *Optic*, or nerve of special sense of sight, enters the eye and expands into the retina.

3rd.—*Motors Oculorum*, a motor nerve, is distributed to most of the muscles of the eye.

4th.—*Pathetic*, a motor nerve, the smallest of the 12, is distributed to the superior oblique muscle of the eye.

5th.—*Trifacial*, a nerve of common sensation and motion and indirectly of special sense, is the largest crainal nerve, and belongs to the class of mixed nerves. It is divided into three branches, viz.: the Ophthalmic, Superior Maxillary and Inferior Maxillary branches. The *Ophthalmic* subdivides into the frontal, lachrymal and nasal. The frontal is distributed to the skin of the forehead and the muscles above the eye; the lachrymal to the lachrymal gland, and muscles and skin of the anterior part of the ear; the nasal to the pituitary membrane on the walls of the nasal fossa; it gives a branch to the membrana nictitans and one to the lachrymal sac. The *Superior Maxillary* branch subdivides into the Orbital, Anterior Palatine, Posterior Palatine, Nasal and Dental branches, which supply the parts their names indicate. The *Inferior Maxillary* branch is the largest of the three and subdivides into the Masseter, Buccal, Internal Pterygoidean, Lingual, Mylo-hyoidean and Dental branches. The *lingual* is the nerve of the special sense of taste.

6th.—*Abducens*, a motor nerve, supplies the abductor oculi and the external portion or retractor oculi muscles.

7th.—*Facial*, a motor nerve, goes to the muscles of the face.

8th.—*Auditory*, the nerve of special sense of hearing, supplies the internal ear.

9th.—*Glasso-Pharyngeal*, is a mixed nerve distributed principally to the tongue and pharynx.

10th. –*Pneumogastric*, a mixed nerve, is remarkable for its extent and for the numerous dissimilar organs it supplies. It gives branches to the various respiratory organs and to the stomach and œsophagus. It also gives branches to the heart and lungs. It anastimoses freely with other cerebro-spinal and with the sympathetic nerves.

11th.—*Spinal accessory*, a motor nerve, arises from the whole extent of the cervical portion of the spinal cord and receives filaments from the brain. It is distributed chiefly to the muscles of the neck and shoulders.

12th.—*Hypo-Glossal* is a motor nerve, and is distributed to the muscles of the tongue.

Spinal Nerves.

The nerves which emanate from the the spinal cord and make their exit through the intervertebral foramina are collectively known as the *spinal* nerves. They consist of from 42 to 43 pairs and are divided according to the regions into 8 cervical, 17 dorsal, 6 lumbar, 5 sacral, and 6 or 7 coccygeal pairs. The whole of the spinal nerves originate by two orders of roots, *superior* or *sensory*, and *inferior* or *motor* roots. The former are larger and more numerous, arising from the superior lateral fissure, and the latter from the inferior lateral fissure of the cord. In the intervertebral foramina there is a ganglion on each of the superior roots underneath which the inferior root passes. The union of the two roots constitutes the spinal nerve which, immediately on passing through the foramen divides into two branches, a superior, distributed to the spinal muscles and skin which covers them, and an inferior, longer and larger, distributed to the inferior and lateral parts of the trunk, and in some cases to the extremities. The spinal nerve sends various communicating branches to the sympathetic system.

Sympathetic System.

The *Sympathetic*, or ganglionic system of nerves, the nerves of organic life, consists of two large cords or chains of nerves, which extend from the head to the posterior extremity of the sacrum, under the lateral parts of the borders of the vertebræ on each side of the columns, These nerve cords are furnishe l with a number of ganglia,

which both give and receive numerous communicating filaments from the cerebro-spinal nerves. A sympathetic ganglion is a nerve centre to which converge various so-called *afferent* branches, motor, sensory, and sympathetic, while the filaments which leave the ganglion to supply the various organs are known as emergent or *efferent* branches, which thus exercise a mixed and varied function. They supply the blood vessels, glands and viscera. The sympathetic system is divided into five regions, viz. : the Cephalic, Cervical, Dorsal or thoracic, Lumbar or abdominal, and Sacral or pelvic.

Aesthesiology.

We will now consider the organs of special sense and common sensation.

The *Ear.* The apparatus of hearing is composed of three parts, viz. : the external, middle and internal ear, the two first being accessory, for the collection and transmission of sound, and the latter the essential organ, which receives the impressions thus conveyed.

The *external ear* consists of the *concha*, or projecting shell-like orifice, and the *meatus auditorius externus*, or passage which extends from the concha to the tympanic membrane bounding the cavity. It is partly osseous and partly cartilaginous, and is narrower in the middle than at either extremity. Its lining is a continuation of the skin of the concha, and it gradually becomes thinner as it descends, and is perforated by a number of small openings from the *ceruminous glands* which secrete the wax of the ear. The cartilages of the external ear are the *conchal*, *annular* and the *scutiform*. The mobility of the organ in the solipedes is so great that it is regarded as the chief organ of expression.

The *middle ear*, or tympanum, is an irregular long cavity within the petrosal bone. It is bounded externally by the membrana tympani, or *drum* of the ear ; internally by the bony walls of the internal ear, anteriorly by the Eustachian tubes, and posteriorly by the mastoid cells· A chain of bones, the auditory ossicles, stretch across the tympanum. They are the *malleus*, *incus*, *stapes* and *lenticular* bone or *os orbiculare*. The cavity is filled with air and communicates with the pharynx by the

Eustachian tubes. The chain of bones transmits the impression received from the membrani tympani to the internal ear, upon which the auditory nerve is distributed.

The *internal ear*, or labyrinth, is the ultimate part of the organ of hearing, and consists of the *vestibule, semicircular* canals and *cochlea*. It consists of a series of cavities hollowed out of the petrous portion of the temporal bone communicating externally with the middle ear through the *fenestra ovalis* and *fenestra rotunda*, and internally with the cranial cavity through the *meatus auditorius internus*, which transmits the auditory nerve.

The Eye.

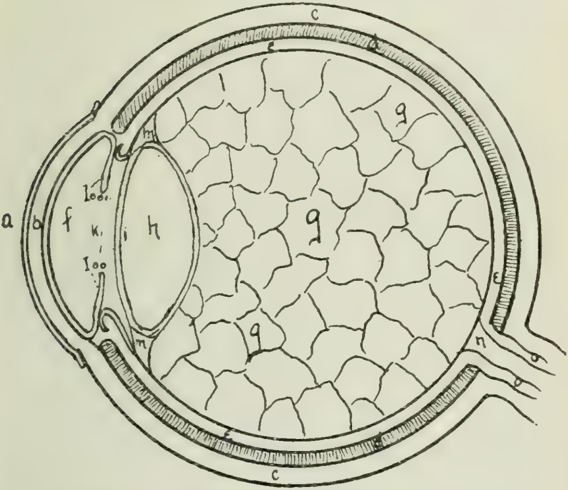
The apparatus of vision comprises the essential organs, the globe of the eye or eye-ball, and its accessory parts or appendages. The *globe* of the eye is spherical in form, having the segment of a smaller sphere engrafted on its anterior surface, and increasing its antero-posterior diameter. It consists of a membranous sac containing certain transparent humours of different densities, which serve as refracting media. It is attached to the orbit by the muscles which move it, and reposes on a cushion of fat which not only maintains it in its proper position, but also assists in steadying its movements.

The *Tunics* of the *eye* are three in number: 1st, the *Sclerotic* and *Cornea*; 2nd, the *Choroid* and *Iris*; and 3rd, the *Retina*. The sclerotic coat and cornea form the external tunic. Four-fifths of the globe are invested by the sclerotic, the remaining one-fifth by the cornea.

The *sclerotic* coat is a dense white fibrous membrane, which extends from the insertion of the optic nerve to the cornea. Its external surface is in connection with the cellular and adipose tissue and with the muscles of the eye-ball, the tendons of which expand over it and form a thin tendinous layer, the *tunica albuginea*, which is partly covered by the conjunctiva and forms the white of the eye. Its internal surface is attached to the *choroid* coat by cellular tissue. Its anterior opening is elliptical, and presents a bevelled edge, which receives the cornea in the manner in which a watch glass is received by the groove in its case. Posteriorly it is pierced for the passage of the optic and ciliary nerves and the ciliary arteries.

The *Cornea* is composed of two layers, the *cornea propria* and the *cornea elastica.* It is transparent and elliptical and fits into the groove in the sclerotic. Its anterior surface is convex, its posterior concave.

DIAGRAM OF SECTION OF EYE.



a. Conjunctira, *b*. Cornea. *c*. Sclerotic Coat. *d*. Choroid Coat. *e*. Retina. *f*. Aqueous Humour. *g*. Vitreous Humour. *h*, Crystalline Lens, *i*. Capsule of Cr. Lens. *k*. Pupillary Opening. *l*. Iris and Corpora Nigra. *m*. Ciliary Processes. *n*. Retinal Artery, *o*. Optic Nerve.

The *second tunic* of the eye-ball is formed by the choroid and iris. The *choroid* coat is a thin, vascular membrane of a brownish or black colour. It is composed of three layers, external, middle and internal. The *external* consists principally of veins, "*vena vorticosa*," with pigment cells, to which its colour is due. The *middle* layer is formed by the ciliary arteries, which form a fine capillary plexus called the *tunica Ruyschiana*. The *internal*, or pigmentary layer, is composed of hexagonal cells, containing black pigment granules. On the posterior wall

the black pigment is absent, causing a peculiar bluish lustre, which, owing to its brilliancy, has received the name of the *tapetum lucidum*. The *ciliary muscle* is a white ring of fibres which forms the bond of union between the external and middle tunic of the eye. The ciliary processes, from 60 to 80 in number, are arranged in a circle, and are formed by the plating or folding inwards of the middle and inner layers of the cornea. Their circumference is attached to the ciliary muscle and their central border is received between corresponding folds of the suspensory ligament of the crystalline lens or zonula of Zinn.

The *iris* is a thin diaphragm or curtain, suspended immediately in front of the crystalline lens, its 'periphery being connected with the choroid coat and ciliary muscle, and its centre being pierced by an elliptical opening, the *pupil*. It is variously coloured, but in the horse is generally brown, with more or less of a yellow tinge, but sometimes it is almost white or grey, when the animal is said to be "wall-eyed." Its anterior surface is slightly convex, and its posterior surface covered with a deep purple ligament, called the *uvea*, from its resemblance in colour to a ripe grape. Two sets of fibres enter into the formation of the iris, one of which, converging from the circumference to the centre, has the power of dilating the pupil; the other, surrounding the margin of the pupil on its posterior surface and blending with the radiating fibres, has the power of contracting it. The small bodies on the upper pupillary margin of the iris, three or four in number, are the *corpora nigra*, their use appearing to be that of concentrating the rays of light, and preventing their too direct passage through the pupil.

The *third tunic* is the *retina* which is prolonged forwards to the ciliary processes. It is the terminal expansion of the optic nerve over the internal surface of the choroid coat from which it is easily separated. It consists of nine layers, viz., 1st, Internal limiting layer; 2nd, Optic nerve fibres; 3rd, Ganglionic cells; 4th, Internal molecular layer; 5th, Internal granular layer; 6th, External molecular layer; 7th, External granular layer; 8th, External lining membrane; 9th, Basilary layer, or rods and cones. The *ciliary* zone, or Zonula of Zinn, is a thin vascular layer which connects the anterior margin of the retina

with the anterior surface of the lens, and presents a number of folds which are received between corresponding folds of the ciliary processes.

These, the reflecting media, are three in number, viz.: the aqueous and vitreous humours, and the crystalline lens.

Humours of the Eye.

The *Aqueous* humour consists chiefly of water with an alkaline reaction, and completely fills the anterior and posterior chambers of the eye; both chambers are lined by a serous membrane which secretes the aqueous humour. The *anterior* chamber is the space between the internal surface of the cornea and the iris, pupil and ciliary muscle. The posterior chamber is the narrow space bounded in front by the iris, and behind by the capsule of the lens.

The *Vitreous* humour occupies about four-fifths of the whole interior of the globe. It is a highly albuminous and perfectly transparent substance of the consistency of jelly, enclosed in a delicate membrane, the *hyaloid*, from the inner surface of which numerous lamella are sent inwards to form the compartments in which the fluid portion is contained. If this fluid escapes, or be destroyed, it will not be reproduced.

The *Crystalline* humour, or lens, is situated immediately behind the pupil, in front of the vitreous humour, and is surrounded by the ciliary processes which slightly overlap its margin. It is bi-convex, the convexity of the posterior face being the greater and is held in position by attachments formed by prolongations of the capsule which envelopes it, which unite with the ciliary processes prolonged from the retina. No blood vessels have been found in the crystalline lens, but it is known to be organised by the fact that growth and other changes take place.

The Corpora Nigra.

The *Corpora Nigra*, as the name implies, are small, black, globular bodies belonging to the posterior or rearmost lining of the iris, and form a fringe around its margin. On the upper margin they are three or four in number, on the lower margin one or two are usually found. The purpose of these structures is to modify the rays of light

and screen the interior of the eye from light rays from an extreme angle, either from above or below. To a certain extent they take the place of eyebrows, of which the horse has none.

The Optic Nerve.

The optic nerve comes direct from the brain and enters the eye by means of a round aperture at the posterior lower portion of that organ. The prolongation and extension of the optic nerve forms the retina or inner tunic of the eye. The optic nerve is the organ which transmits the impressions received by the eye to the brain and is essential to complete the phenomenon of sight.

The two eyes of an animal are intimately connected by their nervous system, which is identical in each. Contraction of the pupil of both eyes will take place when only one is exposed to strong light, just as the movement of one eye is always accompanied by a similar movement of the other. Hence disease of one eye is liable to affect the other, and even an external injury to one will set up sympathetic irritation in the other.

Appendages of the Eye.

The appendages of the eye consist of :—the eyelids eyelashes, the lachrymal or tear glands, the muscles governing the movement of the eye, and the haw or membrana nictitans, as well as long hairs found scattered above the eye, in that place where one would expect to find eyebrows. These hairs are credited with a fine sensibility to touch.

The *eyelids* are made up of skin which is very fine and thin, muscular tissue, mucous membrane, and numerous glands which secrete a lubricating material. The eyelids act as curtains and protect the eye against light and material objects. They are lined with conjunctival membrane, which is a continuation of that same membrane found in the make up of the eye itself.

The *eyelashes* are found on the margins of the lids. They are fine hairs which act as a light filter and give protection. They are very sensitive. These hairs are longest and most numerous on the upper lid, especially at the outside corner.

The *lachrymal glands* are situated in the outside or exterior and upper angle of the orbit, and secrete a saline solution for the lubrication of the eye. When the eye is

subjected to irritation, such as the entry of foreign matter, inflammation due to cold, etc., these glands secrete increased quantities of their solution until quantities of it will drop from the orbit in the form of tears.

The *muscles of the eye* are numerous and powerful as the rapid movement of which the eye is capable would indicate. In the horse, the muscle designed for withdrawing the eye into its socket (retractor oculi) is very highly developed and can be operated at will.

The *membrana nictitans*, or haw, is situated in the inner corner of the orbit and consists of a sensitive cartilaginous substance, triangular in shape and slightly concave. It protrudes itself over the eye when extraneous matter inserts itself on the cornea and passing over the whole surface removes the foreign object, whatever it may be, as it withdraws again into its corner. This membrane makes any operation on the eye very difficult as it is almost involuntary in its movement and insinuates itself over the external surface of the orb whenever it is touched.

The Foot.

The foot of the horse is made up of (*a*) the hard, external, insensitive structures which contain and protect (*b*) the soft, sensitive, vascular structures, and (*c*) the bones enclosed by them.

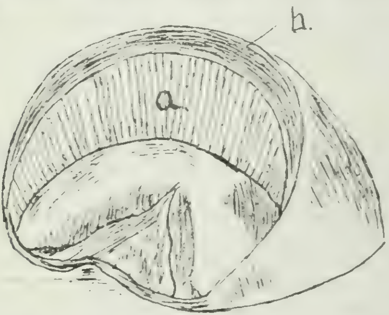
The external parts of the foot are three in number: (1) the crust, or wall, and the bars, (2) the insensitive sole, and (3) the external frog.

Inside the crust lie the *os pedis*, or coffin bone, part of the *os coronæ*, or small pastern bone, and the *navicular*, or shuttle bone, which is situated behind and in conjunction with the articulation of the pastern and coffin bones Between these bones and the outer crust are various soft, highly vascular and sensitive tissues which act as a cushion and also carry a large number of blood vessels, provide a tissue for the growth of sole and other horny materials and attachments for ligaments and tendons. They are (1) the sensitive laminæ, (2) the sensitive sole, and (3) the sensitive frog. In conjunction with the organization of the foot is another tissue known as the coronary band, which is found around the upper edge of the wall, and will be discussed later.

Insensitive Tissues.

The *Wall* comprises the external covering of the foot, as seen when the foot is on the ground. It is divided into the *toe*, or front portion, the *quarters*, and *heels*. Viewed from above it is oval in shape, straightening out towards the heels, where it turns inwards and forwards, forming the bars, which run parallel to the frog and give additional strength to the crust. Viewed from the side the wall makes an angle of 45° to 50° with the ground, becoming more vertical as the heels are reached. (The inside quarter is more upright than on the outside of the foot, and the fore foot is rounder than the hind foot and makes a smaller angle with the ground.) The wall is thickest at the toe, becoming slightly thinner toward the upper extremity and also thinner towards the heels.

A



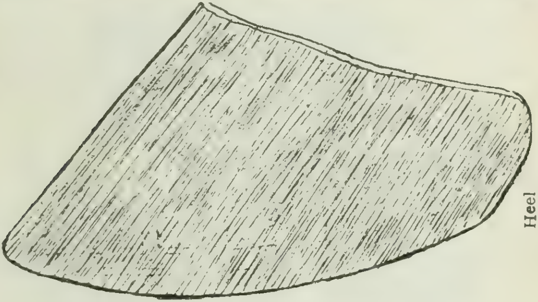
A.—Perspective Diagram of External Crust, showing:—
a. Internal Laminated Structure. *b*. Seat of Caronary Band.

The wall consists of horny fibres, which run longitudinally from above downwards (see Fig. B), being secreted by the *coronary band*, a cartilaginous structure found running round the top of the wall and in a groove on its inner aspect. The fibres are really small tubes of horny material filled with and attached together by a glue-like gelatinous material. This glue-like material also forms an external covering to the wall, preventing evaporation of moisture (the wall contains about 25 per

cent. of moisture). When the outside of the hoof is rasped this protection is removed, and the fibres become dry and brittle.

The internal surface of the wall (Fig. A) consists of a number of laminæ, or leaves, which run in a perpendicular direction, and dovetail into the sensitive laminæ. These laminæ are about five hundred in number, and present a number of secondary laminæ on their surfaces, which effect a more complete union with the sensitive tissue.

B



B.—Diagram showing direction taken by Fibres of Wall.

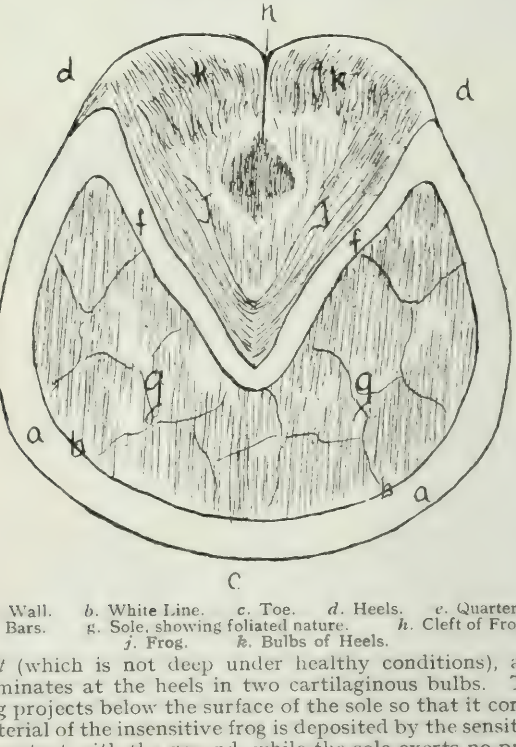
The *Sole* is that portion of the external hoof on the lower or ground surface, filling in the space enclosed by the bars and the wall. It is concave to the ground, and unites with the wall at the lower extremity of the latter, the place of union being marked by the so-called *white line* (see Fig. C).

The insensitive sole consists of thin layers of horny material, which afford protection to the inner, sensitive sole. The inner surface of the insensitive sole has a somewhat honeycombed formation, where the projecting papillæ of the sensitive sole fit into the tiny wells. It is here that the horny matter of the external sole is secreted. As the growth of horn continues thin flakes fall away from the lower surface after their work has been performed and the external layers have become broken down by exposure. The sole is usually more concave in hind feet than in fore feet.

The *Frog* is a triangular pad, made up of insensitive

horny material, which is quite elastic in nature, and fills up the space between the bars of the crust. Its widest portion is at the posterior border of the foot, its apex being situate approximately in the middle of the ground surface of the foot. The frog is divided down the centre at the ground surface by a commissure, known as the

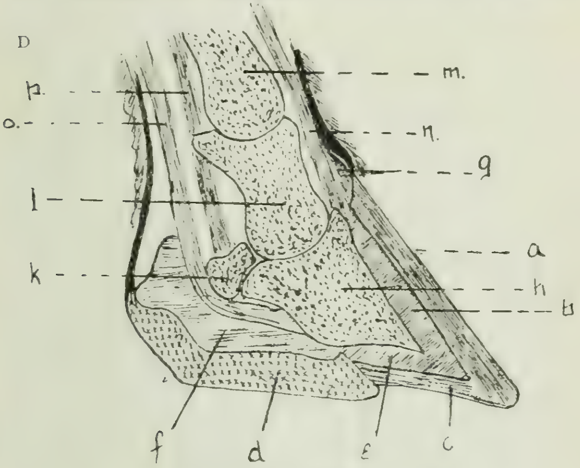
C.—LOWER SURFACE OF FOOT.



a. Wall. *b*. White Line. *c*. Toe. *d*. Heels. *e*. Quarters. *f*. Bars. *g*. Sole, showing foliated nature. *h*. Cleft of Frog. *j*. Frog. *k*. Bulbs of Heels.

cleft (which is not deep under healthy conditions), and terminates at the heels in two cartilaginous bulbs. The frog projects below the surface of the sole so that it comes material of the insensitive frog is deposited by the sensitive in contact with the ground, while the sole exerts no pressure on the ground when the surface is level. The horny

or "fatty" frog, which is in contact with and situated directly above it. The purpose of the frog is to act as a cushion to the foot and absorb the shock of concussion with the ground. It also helps to keep the animal from slipping on smooth surfaces, and by its lateral expansion when in contact with the ground keeps the heels widened



D.=VERTICAL SECTION OF FOOT.

a. Wall. *b*. Sensitive Laminæ. *c*. Insensitive Sole.
d. Insensitive Frog. *e*. Sensitive Sole. *f*. Sensitive Frog.
g. Coronary Band. *h*. Os Pedis. *k*. Os Naviculæ.
l. Os Coronæ. *m*. Os Suffraginis. *n*, Extensor Pedis Tendon.
o. Flexor Perforans Tendon. *p*. Inferior Sesanoid Ligament.

and prevents contraction at that point. Where the foot is so treated that contact between the frog and the ground is not effected, we find that the frog becomes diminished in size and consequently its usefulness is lowered.

Sensitive Structures.

The *Coronary Band*, which is situated in a concave oblique groove running around the upper and inner edge of the wall, is supplied with densely set blood vessels, connected by a fibrous tissue, and secretes the horny material of which the wall is made.

The *Sensitive Laminæ* are highly vascular and sensitive. They correspond in number to the laminæ on the inside surface of the wall into which they fit, and are attached interiorly to the coffin bone by dense connective tissue, completing the union between the bone and the external crust. When necessary, the sensitive laminæ are capable of secreting horny material for their protection.

The *Sensitive Sole* is found between the lower surface of the coffin bone and the upper and inner surface of the insensitive sole, acting as a cushion between these two hard structures. It is similar to the sensitive laminæ in that it is a sensitive and vascular tissue, and is attached to the coffin bone. On its ventral or lower surface are numerous papillæ, which fit into the corresponding depressions of the inner surface of the horny sole, and give attachment as well as secreting the horny material which comprises the insensitive sole. This deposition of horny material takes place very quickly whenever a part of the external sole has been removed by accident or for surgical reasons, and protection to the sensitive tissue is soon brought about.

The *Sensitive Frog*, or fatty frog, as it is sometimes called, is located immediately above the external insensitive frog and occupies the space between the wings of the os pedis and extends upwards to the navicular bone, which it supports. It also gives support to the coffin joint. In the centre of the sensitive frog on its lower surface is found a depression corresponding to the cleft of the external frog, which gives additional elasticity, and is called the *frog stay*. The horny frog is deposited by the sensitive frog.

In addition to the above tissues and the bones of the foot (which have been described elsewhere) are found also the ends of the flexor and extensor ligaments of the leg at their points of attachment.

The *Foot of the Ox* differs from that of the horse in that it is cloven or divided in two halves, each section containing three bones, as in the horse, so that the whole foot contains twice the number of bones that we find in the horse. The sensitive and insensitive tissues are present and secreted in the same way, but the laminæ and villi are finer in size. Further, there is no frog in the foot of the ox.

Building the Rural Community

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BUILDING THE RURAL COMMUNITY

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In the interests of a Rural Community Life Movement, to create Communities throughout Canada wherein the five fundamental social institutions will co-operate in the common task of Character Development and Community Welfare. Such Communities will radiate the Community Spirit which shall finally bind all Communities and Nations together in a World Brotherhood.

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Building the Rural Community

In presenting this problem, one of the most urgent that will face us in the Reconstruction Period after the War, the object of these booklets is twofold : *First*—to marshal before the mind's eye of the reader in brief outline some of the great far-reaching questions—domestic, educational, social, religious, economic, political, national and international—which will face us all as we return to Canada. In this connection we will suggest questions for informal group discussion which, together with the bibliography given, may open up the way for further study and mastery when all have returned to civil life and are busy once more in the upbuilding of that "Democracy for which the War has made the World safe." *Second*—to emphasise particularly the Community Centre idea and method.

THE IMPORTANCE OF THE QUESTION.

If you have any doubt as to the paramount importance of the question of Rural Life in Canada, consider for a moment the significance of the following statements, facts and figures, gathered from various sources :—

1. Over 50 per cent. of Canada's population is rural.
2. Repeated tests made in great gatherings of national leaders have shown that about 80 per cent. of those present were country born.
3. The class that produces the world's food supply must be reasonably happy and prosperous.
4. Agriculture is the foundation of national life: e.g., food, shelter, clothing, materials for industries, manufacture, commerce, transportation and banking, all depend on agricultural production.
5. The late Theodore Roosevelt said: "No nation has ever achieved permanent greatness unless this greatness was based on the well-being of the great farmer class . . . for it is upon their welfare, material and moral, that the welfare of the rest of the nation ultimately rests."
6. J. J. Hill, the great railroad magnate, said: "A prosperous agricultural interest is to the nation what good digestion is to a man. The farm is the basis of all industry. The soil is the only resource that renews itself continually after having produced value. . . . For many years this country has made the mistake of unduly assisting manufacture, commerce and other activities that centre in the city, at the expense of the farm."

WHAT IS THE PROBLEM?

Do you believe there is a problem? Is everything as it should be in Canadian Rural Life? Listen to what

great leaders the world over say as to rural life. Sir Horace Plunkett, the great Irish rural life leader, says: "Better farming simply means the application of modern science to the practice of agriculture. Better business is the no less necessary application of modern commercial methods to the business side of farming. Better living is the building up in rural communities of a domestic and social life which will withstand the growing attraction of the modern city." These three, and the second to come first, are the planks in his platform of solution and constitute the problem as he sees it.

The late Theodore Roosevelt said: "Our attention has been concentrated almost exclusively on getting better farming. In the beginning this was unquestionably the best thing to do . . . But when this has been secured, the effort for better farming should cease to stand alone, and should be accompanied by the effort for better business and better living on the farm. . . . Agriculture is not the whole of country life. The great rural interests are human interests, and good crops are of little value to the farmer unless they open the door to a good kind of life on the farm. . . . How can the life of the farm family be made less solitary, fuller of opportunity, freer from drudgery, more comfortable, happier and more attractive?"

Dr. J. W. Robertson, Chairman Agricultural Committee, Commission of Conservation, Ottawa, says: Rural depopulation (one of the most marked indications that there is a problem, *Ed.*) is caused partly by ease of travel, the lure of the city and machine production on the farm. (In 1855 the production of one bushel of corn required 4½ hours; in 1890, only 41 minutes.) Satisfaction in labour (without which there will always

be the problem, *Ed.*) has three elements: (1) Material reward or wealth; (2) Social enjoyment of the work; (3) Individual pleasure in doing the work. "The tawdry and slovenly way we follow farming in Canada is one of the main causes, in my judgment, for people leaving the farm."

The Commission on Country Life, appointed by the late Ex-President Roosevelt to investigate country life and its problems, analyses the question as follows: (1) Agriculture is not as profitable as it is entitled to be. (2) Social conditions are far short of their possibilities. (3) The farmer is handicapped by small capital, limited volume of transaction, lack of organisation, inequalities and discriminations in taxation, legislation, restraint of trade and monopoly of natural resources. (4) Lack of knowledge of exact agricultural conditions. (5) Lack of good training for country life. (6) Lack of good highway facilities. (7) Depletion of soil. (8) Lack of active, resident leadership. (9) No adequate system of agricultural credits. (10) Shortage of labour. (11) Lack of institutions that tie men to the soil. (12) Hardship of woman's life on the farm. (13) No adequate supervision of public health.

E. R. Groves, Professor of Psychology, State College, Durham, New Hampshire, says: "Striking illustrations of individual preference for city life, even in opposition to the person's economic interests, suggest that this problem of social behaviour (urban migration), so characteristic of our time, contains important mental factors."

L. H. Bailey, Dean of Agriculture, Cornell University, New York, has for two decades been calling to the farmer to "awaken" to a sense of his power. He has summoned

the rural community to "redirect" its rural forces, to gain a "new outlook," to "spiritualise" its life and institutions. The solution is such a management of state and federal agencies as shall convey to the farmer confidence in his own capacity. Reliance upon resident rural resources seems to be the basic principle in this ruralist's philosophy. He is the farmer's Emerson, saying, "Trust thyself."

Kenyon L. Butterfield, President Massachusetts Agricultural College, says: "The farm problem consists in maintaining upon our farms a class of people who have succeeded in procuring for themselves the highest possible class status, not only in the industrial but in the political and social order—a relative status, moreover, that is measured by the demands of American ideals. The farm problem thus connects itself with the whole question of democratic civilisation."

The Commission of Country Life sums up at the end of its report: "Everything resolves itself in the end into a question of personality. Society or government cannot do much for country life unless there is voluntary response in the personal ideals of those who live in the country."

The foregoing hurried and brief survey of the opinions of men whose authority in these questions cannot be doubted, indicates that the problem of country life is a very wide and complex one. It is not one of correcting a condition here and there but is one of reconstruction. The work before us is nothing short of the rebuilding of agriculture and rural life. It is truly one of the greatest problems of Reconstruction after the War.

Something like general agreement may be secured as

to what, in broad outline, constitutes the problem before us, but when we begin to discuss ways and means of solution then there is liable to arise many differences of opinion. A careful study of the various opinions presented above will, we are sure, convince you that before we can advance very far towards a right solution of the many complicated problems involved we must have three things at least: FIRST,—*Knowledge.* The intricacies of the various phases of the problem must be known, which involves careful, sincere, unbiased investigation of many kinds (by Government and private institutions), similar to what has already been started, e.g., surveys of soils, farm management, markets, social conditions, institutions, etc. SECOND,—*Education.* The facts discovered must become part of the life of all members of rural communities, which necessitates redirection of curricula, methods, etc., of Public School, High School and College, and a system of College Extension Work which will carry to the home of the farmer not only technical and business knowledge, but direction and inspiration in social and community life. THIRD,—*Community Organisation and Effort.* Before knowledge becomes action we must have community of interest, purpose and spirit—or, in other words, a general willingness to co-operate in securing common ends—often called Community Spirit—the creation of which necessitates a programme of getting-together activities or organisation. The whole Community must be permeated by a spirit of good fellowship and righteousness, which will necessitate the revitalising of the message, mission, and activities of the Country Church and an extended programme of Community Play and Recreation. "The ultimate need of the open country is the development

of community effort and of social resources."—*Country Life Commission.*

With these three ends in view we offer for your consideration the suggestion that through the establishment of a great variety of social contacts and the frequent bringing together of all the folks of a community for discussing, playing, working, or, in fact, doing anything together, there will gradually be developed a community of knowledge, idea and spirit which will lead to community of purpose and action. By community of action alone can some of the most troublesome of rural economic, political, educational and religious problems be solved.

Our task then is to learn, if possible, how to build rural communities having community of spirit, purpose, and action.

COMMUNITY BUILDING AND COMMUNITY BUILDERS.

From an analysis of the above presentations of the problem, with their various viewpoints, it will be seen that there are certain principles which must be observed if success is to be secured. Among these principles are the following:

1. A Community Bull's Eye.—A common aim for community effort is needed—big enough to appeal to all. At the centre of every phase of the rural problem lies the human problem—the question of character or personality. There can be no bigger, nobler, or more appealing aim than character development. Without the emphasis on character no proposed solution will satisfy; with it many proposed methods will lead to an ultimate solution. The Bull's Eye that every effort

of rural society should ultimately aim for is the development of character. Such character among other features will have the conviction :—

(1) That character, although invisible and intangible, is the most real and important part of man, and that its quality determines everything that happens in a community.

(2) That each individual has some peculiar contribution to make to the progress of society—which, if withheld, delays the coming of real democracy. Therefore, *individuality* of character must be recognised, developed and used.

(3) That each person must be trained in his proper relationship, responsibilities and duties to home and community life—must become informed on community problems—must recognise, accept and discharge his obligations to the Community, not as a virtue, but as a natural duty of the larger growth of human character. "One's very personality is social in origin."—*Groves*. How much are our characters dwarfed because someone neglected their social obligations to us ? How many characters will be dwarfed if we refuse to do our duty to the Community ? That this community conscience is not yet awake is manifested in the individualistic way in which we regard such matters as roads, schools, churches, business, etc.

(4) That each Canadian in these days of world unrest must realise himself as a part of the larger Community—Canada. Each must seek to understand the other classes of the nation and learn to live in peace and class co-operation within the Dominion. Danger lies in any other view of life.

(5) That, conscious of the importance of character, with all our capabilities trained, performing our duties in the community and national life, we must also be conscious of the mission of Canada to serve the world in helping to bring in a universal brotherhood and League of Nations.

It is a comparatively easy matter to outline the kind of character that each individual should have—the difficult thing is to so direct our efforts, both personal and institutional, that only that type of character will be produced. Our contention is that without some form of community social centre effort such character will not be formed to any great extent. Much more can also be done by such institutions as the school, church and business organisations, by redirecting their efforts, to produce such a type of character. Some of the changes necessary with this end in view will be discussed in future pamphlets on the Home, School, Church, etc.—in the present pamphlet we are specially concerned with the Community Social Centre and its operation.

2. The Rural Community—what is it ?—We all know what a village, town or city is. They have definite boundaries. Is there such a thing as a rural community whose boundaries can be somewhat definitely fixed ? If so, how is it done ? Warren H. Wilson, a great American rural leader, defines the rural community as " that territory with its people which lies within the team haul of a given centre." The ties that bind people together in a community are mutual, social, educational, religious, business and other interests. That the definition holds true to a very marked extent may be proved by any one who will take the trouble to mark on the map around his own village or centre all the families

who trade with it or have other social interests drawing them to it. If we are to do successful community building we must grasp and understand this principle of the Community. The boundaries of many communities are very vague and in others very distinct, but in all much can be done to establish them more definitely and create within them a deeper community consciousness. How this may be done will be discussed later. Professor C. J. Galpin, University of Wisconsin, who has done much precise work in this connection, says: "We are ready now to assert with assurance that we have discovered the fundamental socio-economic rural community unit. This unit is repeated in the structure of rural society, as certainly as the cell is repeated in the structure of organic tissue. It stands above the family unit and above the neighbourhood unit, and consists of both the business centre and the land foundation." His rural life theory hinges upon the discovery of a repeating socio-economic unit of local rural territory and population.

We personally believe that the Community is destined to become the unit of effective organisation in a great democracy. Some effective organisation is required for continuously educating the electorate. Here in the Community is the physical, social and geographical basis for visible association and organisation.

3. Picture of a Community as it may be.—Provided with an ultimate aim, and a clear idea of the general physical outline of the social organism, we need now to get a vision of the possibilities of the new rural social structure, developed within the Community from the local resident forces of the country. We must then set ourselves to the task of realising the vision by calling

on the agencies present to make their contribution to the whole structure. We, too, must take our place in these social forces, to lead, inspire and achieve. The Community we wish you to see will be somewhat as follows :—

(1) *A Community Home or Centre.*—It is characteristic of human nature to demand some concrete expression of inner ideas or conceptions, and so in the movement for community building it is necessary to have a centre or home where the Community Idea and Spirit may assume concrete form. This centre will be a forum where all questions of interest to the Community will be discussed, free of all prohibition, conclusions arrived at and action agreed upon. Implicit trust must be placed in the power behind democratic ideals. It will be an anvil for shaping community ideals—a magnet to draw all classes, creeds and philosophies—a power house to supply energy to all community enterprises—the head and heart of community life—the repository for all concrete expressions of community ideals, for instance, of beauty, art, music, literature, etc.

Where this centre will be established will depend on circumstances. Where only one church exists in the community, it may be the church; oftener it will be the school-house; again it may be some society hall, or township hall, or remodelled barn, hotel, or other building, or a specially built Community Hall. In some places it may be a group of buildings and grounds such as school, church, creamery, fair ground, etc., all centrally located. Wherever it is, every member of the community must feel that he has a perfect right to use it, because he has paid for it and it belongs to him. Every organisation in the community should be encouraged

and urged to use it as their meeting place. For this reason it should be equipped for many purposes, such as library, art gallery, motion pictures, lectures, dramatics, band, recreation, health exhibits, banquets, playgrounds, lounge and rest room, reading room, small rooms for clubs, etc. It ought to be available every day and all day.

(2) *Community Welfare the Objective.*—Every institution, such as the Home, School, Church, State, and Business Organisation, must realise that the end for which it was created was the stengthening, development and improvement of community life. Each must lose itself in serving the Community. The tendency always is to become institutionalised, lose sight of the true objective, and plan and live for the upbuilding of the organisation itself. The home must realise that it cannot shut itself within its four walls, but that its very life lies in the hands of the Community. A consideration of such subjects as medical inspection of school children, feeble-mindedness, leisure hour problems, Sunday school teaching and public school teaching, will show that the Community is the modern home and that the home must interest itself in everything that happens in the Community, which affects the life and character of its youth, or accept responsibility for the consequences. The school must be a community school, reaching and educating not only children of school age, but every person in the Community. It must be a community institution in the sense also that its subject matter must pertain to life on the farm. The church must be an army mobilised for the purpose of bringing in the Kingdom of God in the Community. It must inspire, with the highest ideals, all movements for progress, economic, social,

recreational, educational, etc. In short, community welfare must be the objective of all organisations.

(3) *A Federation of Forces.*—In order more effectively to carry out the above suggestions, there should be some central council representative of all the organisations, whose chief function would be the development of the community life as a whole to co-ordinate, concentrate and prevent duplication of effort. Each organisation would have a free hand within the Federation. The Community should be an association of individuals and organisations for the common welfare of all. "There is need of the greatest diversity of work—but there is equal need of a social cohesion operating among all these affairs and tying them together. Together they (the social forces) will work, each in his own field, for the one goal of a new and permanent rural civilisation."—*Country Life Commission.*

(4) *Use Present Organisations.*—All the organisation needed is usually present. Discourage new organisation, unless the need is demonstrated. Vitalise the organisations already present by carrying out the programme through them, and so bring them into the Community Life and Spirit.

(5) *The Community—the Field of Operation.*—Each organisation should feel its responsibility for everybody within the Community. If there is one farmer eligible for membership who is not a member of the Farmers' Club—that club has failed in its full duty and is weak to the extent of its uncovered constituency. The same principle applies to all other organisations such as church, school, etc.

(6) *Local Leadership.*—The work must be done by

local resident leadership. No one from outside can do more than inspire and direct the movement. The part of the Government, or any other institution, is investigation, presentation of principles, counsel and inspiration. If the Community from which you come is to make any progress, it may be that it depends on YOU for the first steps. Are you prepared to give yourself to the cause ? Two classes of leaders are called for—lay and professional. Farmers will have to give themselves in service for the Community, each in the way he can serve best—economic, social, educational, etc. Each will have to prepare himself for that service by study, reading, attendance at conferences, and most important of all, by actual participation in Community Life. Professional leaders, such as clergymen, teachers, Government officials, etc., must, in addition to any primary qualifications which their particular task demands, be organisers. It is their duty to discover leadership that lies dormant in members of their communities, and by the skill of the organisers help these individuals to realise themselves as leaders. The temptation of every professional leader is to do the job himself rather than do that which is harder, viz., train someone else to do it. Community building is impossible without developing local lay leadership. This principle is the very heart of the problem of community building.

(7) *An All-round Programme.*—Every phase of farm life must be included in the programme of work of a community—economic, social, educational, religious, domestic, æsthetic, legislative, co-operative, recreative, etc. Lacking any one of them, country life will never be wholly satisfying. We must also keep in mind that all the needs of *every* person in the Community must

be kept in mind without regard to sex, age, caste, creed or race—all have a great many common interests in the Community and can meet on the basis of these interests.

(8) *Interdependence of Communities.*—In developing a rural community we must persistently keep in mind that communities are interdependent. Farmers as a class can never be independent of city folk, and vice versa. This note of warning is introduced here, because of the possible danger of the development of class antagonism. Farmers must become conscious of their important place and function in national affairs, but must also remember that they are first Canadians, which requires loyal co-operation between classes.

SOME FUNDAMENTAL QUESTIONS.

We are conscious of the fact that to many we seem to have been skimming around on the surface. To such people the questions of Single Tax, Free Trade, Economic Justice, etc., are far more important than what has already been said. We recognise and admit the fundamental importance of such questions. Our argument is that such reforms—if they are the correct solutions—will come only as farmers meet together, talk together, work together, play together, and so come to realise their mutual interests and needs, and demand unitedly that they be attended to by the body politic. The Community Centre provides a forum where, in discussion thorough knowledge may be gained, and common ideals may be formed, with regard to such questions as the above. Among other questions that demand our earnest attention in such a forum are:

(1) Wide Government investigations into farm, business, and living conditions—their value and how to make use of them. (2) Extension Work, bringing information, pertaining to all phases of life, to the farm through libraries, lectures, bulletins, correspondence courses, etc.—Are we making as good use of it as we can ? (3) Methods of raising our educational standards and developing a national ideal of character through our educational system. (4) Economic and Legislative questions. (5) Further extension of parcels post, savings bank, good roads, etc. (6) Organisation by farmers of business, credits, insurance, etc. (7) A Dominion Bureau of Health to increase national efficiency. (8) Better housing.

Beyond all these problems, great as they are, looms a greater one, of which these already mentioned are only part, viz., that of achieving Democracy. It is only as we learn our responsibility about the problems near at hand and discharge it that we become fit for the larger duties. Here in the Community Centre Idea is the opportunity. In these days, as we look earnestly for Democracy, and still more earnestly for a League of Nations, we would do well to ask ourselves what possible chance they will have if we have not got organised brotherhood in our own little communities.

SOME PRACTICAL STEPS IN COMMUNITY BUILDING.

With the purpose in mind of creating a Community of Spirit, on the basis of which the far-reaching problems mentioned above may be ultimately and amicably settled, we suggest the following steps :—

1. *Study Group.*—Get together a group of representative people in the Community to study the problem. The group need not be large, but should be of interested people, including clergymen, teachers, doctors, farmers, women, etc. The following books are recommended: "Rural Life," C. J. Galpin—Century Publishing Company, New York. "Studies in Rural Citizenship," Woodsworth—Canadian Council of Agriculture, Winnipeg. "Rural Life in Canada," Macdougall—Westminster Publishing Company, Toronto. "The Challenge of the Country," Fiske—Association Press, New York.

Make the course short. Plan some concrete action to crystallise the result of your study. The Canadian Problems Club (Secretary, Professor R. McIver, Toronto University) or the Rural Community Life Movement of Ontario (Secretary, A. Maclaren, Ontario Agricultural College, Guelph) will be glad to help outline other courses.

Knowledge is power. Conditions can never be rectified until we know their nature and possibilities. A general recognition of the need must be awakened in the Community through the dissemination of knowledge. The study group must awaken the community conscience. Once awakened, tie it up to some concrete community task, such as supplying recreation, improving the school, etc.

2. *Public Discussion.*—Discuss the Community Idea at every opportunity with individuals and at public gatherings.

3. *Associated Activity.*—Initiate and promote some event, such as a Community Life Institute, which will

enlist all organisations in co-operative activity for common ends. For further particulars of Institute see pages 22 and 24.

4. *Community Centre Established.*—Through the study group or club try to have a Community Centre recognised and developed.

5. *Development of Leadership.*—Leadership for every worth-while movement is lying dormant in your Community. Sometimes it is hard to find, but the most unpromising material often has latent capacity. How shall we discover and develop it? We have six methods to suggest: (1) A Study Club. (2) A Literary and Debating Society. (3) A Programme of Community Play. (4) Giving individuals responsibility for specific tasks, commencing easily and gradually increasing the difficulty of the task as their capability grows. (5) Send promising individuals to summer schools, conferences, etc., for information and inspiration, e.g., Summer Schools for Rural Leadership (clergymen, teachers, and others) and Summer Schools for Rural Teachers held by Agricultural Colleges; Agricultural and Domestic Science Short Courses, Farmers' Conventions, Boys' Work Conferences, Sunday School Conventions, etc. (6) A programme of Community gatherings as varied in character and as frequent as possible. (See paragraph 7.)

6. *A Slogan.* — Adopt a slogan which will suggest getting together in the Community, e.g., "Let's get together," "Each for all, all for each," "Human contacts, more human contacts, still more human contacts." Think up one of your own.

7. *Community Gatherings.*—Since the community

spirit grows only in associated activity, we should organise as many social events as possible to bring together the whole Community, old and young. The greater the variety of events, the wider and richer the social experience and community spirit which will result.

Such gatherings might include: (1) A Community Life Institute on Home, School, Church, etc., and their relation to the Community. (For details see pages 22 and 24.) (2) A Ploughing Match. (3) A Play Day. (4) A Literary Society. (5) Lecture Course. (6) Motion Pictures. (7) Singing. (8) Dramatics. (9) Lecture, followed by planning and planting home, church, and school grounds. (10) Banquets. (11) Agricultural Short Courses. (12) Arbour Day. (13) School Fair. (14) Boys' Work Conference. (15) Good Roads Convention. (16) Christmas Tree. (17) Community Pageant. (18) Hydro-Electric Demonstration.

8. *Advertising the Community Idea.*—Have the study group map out your Community. Mark the boundaries as determined by social and other connections with your centre. Adopt a name for the Community. Display copies of the map in prominent places. Use the community name on all occasions possible, e.g., concerts, picnics, etc. Discuss the Community Idea until its significance grips the people of your Community.

9. *Outside Assistance.*—Remember that such organisations as the Women's Institutes, Home Economic Societies, United Farm Women, Farmers' Clubs, Departments of Agriculture, Education, and Health, etc., Agricultural Colleges, Church Boards, Y.M.C.A., etc., are ready to supply speakers and organisers. Call on them for assistance. Bring into your Community those who have messages that will stimulate the activities

of home, school, church, etc. Such subjects as the following are suggestive: "Home Equipment and its Relation to Community Life," "Play and Recreation," "Education for Country Life," "Consolidation of Rural Schools," "The Church and Country Life." The object of such work being to stimulate the life of these various institutions, the speakers should not only give instruction but inspiration.

10. *Surveys*—Nothing will so arouse community conscience as a survey properly carried out. These surveys are varied in form and content; e.g., a medical inspection of school children will do much to stir up public interest in school affairs; a farm management survey, such as at present being conducted by the Ontario Agricultural College, will bring new life into the business of the Community; Church Boards and Sunday School Associations have other surveys to offer. Directions for the Study Group making a Community survey are contained in such books as "Community Study for Country Districts," Anna B. Taft—Missionary Education Movement, New York.

11. *Federation of Social Forces.*—Do not force it. Suggest and help organise community tasks which will demand from each organisation a contribution to the common end. Such united working for common ends will bring federation, in spirit if not in fact, much more quickly than any cut and dried constitution. In the case of a Community Life Institute, ask women's organisations to be responsible for chairman, speaker and programme in the "Home" session, farmers' organisation for the "Business" session, Churches for the "Church" session, and so on. At the close of the Institute a Resolutions Committee might submit a series of resolu-

tions embodying a programme of action for the ensuing year—in each resolution the organisation to carry it through might be suggested. In this way the whole field would be covered, tasks allotted, duplication of effort avoided, and co-operation secured.

12. *Communication.*—Every good road made, every auto bought, every telephone line erected, every rural mail route opened, every new facility for power on the farm and every labour saver put in the home makes it that much easier for people to participate in community life—we ought to be interested in every one of them, and do our part to secure them as quickly as possible.

13. *Keep Aim in View.*—Always measure your activities and achievements by the quality of character they are producing. There is no other permanent standard of value.

14. *Outside Assistance.*—Help along the above lines may be secured through the Community Department, Social Service Council, Winnipeg, Manitoba; Department of Sociology, Manitoba Agricultural College, Winnipeg; and Department of Sociology, Ontario Agricultural College, Guelph.

A SUGGESTIVE YEAR'S PROGRAMME.

There are three sections of the programme, any one of which may be adopted alone without disturbing the working out of the Community idea. It would be well, in making a start, to carry out only the suggestions under No. 1, and as experience is gained add to your programme.

1. *Quarterly Meetings.*—The Study Group might undertake to promote four quarterly Community Gatherings: (1) A Community Life Institute—Friday to Sunday evening—Sessions on the Community, Home, School, Church, Business, Recreation, etc. Distribute responsibility as suggested above under "Some Practical Steps: Federation" (page 22). Time, just before spring work starts. (2) A Community Play Day—an old-fashioned picnic—thoroughly organised so that as many as possible have the opportunity to play. Time, between haying and harvest. (3) A Ploughing Match, and a Cooking, Home Conveniences and Domestic Art Exhibition might be combined. Concentrate on getting as many local competitors as possible. Discourage outside professional competitors. Organise games and finish the day with amateur dramatics. Time, late fall. (4) A Community Christmas Tree. Make it primarily a gift festival to be divided somewhat as follows: (*a*) Flowers and fruit for shut-ins in your own Community; (*b*) Gifts for some provincial project, such as Free Consumptive Hospital; (*c*) Donations for a work of National importance, such as is done among our immigrant friends; (*d*) Gifts for lands across the sea. By way of programme—a pageant might be given, illustrating Community, Provincial and Dominion History and Customs of lands beyond the seas. In this way the Community horizon would be widened and the type of character we want would be developed.

2. *Monthly Meetings.*—For the other eight monthly meetings, try to get each organisation to put on a programme of interest to the whole Community. For example: (1) A Hydro-electric Power Demonstration by the Farmers' Club. (2) Home Conveniences Lecture and Exhibit by the Women's Institute. (3) Arbour Day by the

School Trustees and Teachers. (4) Good Roads Convention by Township Council. (5) Boys' Work Conference by the Churches. (6) Lecture and Demonstration on Play by Young People's Societies. (7) Two-day Stock Judging Course by Department of Agriculture. (8) Visit of near-by Boards of Trade—discuss Town and Country Relationships.

3. *Weekly Meetings.*—A Literary Society might be organised for the development of local talent, which would meet once during each week which was free from any of the above programme. Some portable moving picture machine might be used as a centre of attraction around which to build local talent programmes, including dramatics, debates, oratorical contests, community singing, etc. During the summer months a Recreation Association would take its place and an evening or half day each week be devoted to play and recreation.

None of the above programme need necessarily interfere with the regular business meeting of any organisation, and if properly planned through some Community Council, could be carried out using only one night a week except on occasional weeks when two nights might be required.

The endeavour in this pamphlet has been to give a broad outline or a view of the problems of rural life in their relationship to the Community Social Centre method of approaching their study and solution. In further pamphlets the particular function of such institutions as the Home, School, Church, State, Farm Business Organisation and Community Federation in working out the whole problem will be considered more in detail, and the contribution of a Programme of Play and Recreation will be discussed.

QUESTIONS ON "BUILDING THE RURAL COMMUNITY."

1. What result is Army life likely to have upon the future needs of men from rural districts ?

2. What in your opinion is the most important thing to be done for the general betterment of country life ?

3. What in your opinion is the rural problem ?

4. Why is the rural problem so important to-day ?

5. Make a list of industries, etc., dependent on agriculture. Make a list of those independent of agriculture.

6. How is the rural question related to the high cost of living ?

7. Which phase is most fundamental—better farming, better business, or better living ?

8. Is there any recognised social centre in your home community ? If so, where is it ? Is it satisfactory ? If not, why not ?

9. What in your opinion is the best social centre for a rural community ? Why ?

10. Do the farmers, their wives and families in your home neighbourhood get together for mutual improvement, entertainment, and social intercourse as much as they should ? Suggest improvements.

11. Suggest a good slogan for a rural community to use, which would suggest the necessity for getting together or of co-operating.

12. Why is it necessary to have good roads in a community ?

13. Do you know the boundaries of your own home community ? How are they determined or fixed ?

14. Enumerate what features you would like to see in your community.

15. Enumerate all the interests of a rural community that you can think of.

16. Are the Home, School, Church, State, and Farmers' Business Organisations doing all they might for your home community ? If not, suggest how they might be improved.

17. What should be the common aim or goal of all organisations in rural life ?

18. How are leaders developed ?

19. If you wanted to carry on community work in your home community, how would you start ?

20. Where, outside of your community, could you get assistance in your project ?

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If you are interested in this matter and would like to be put in touch with those who are promoting its interests in Canada please fill out the attached form and mail to :—

A. MACLAREN,

DEPARTMENT OF AGRICULTURE,

Khaki University of Canada,

31, Bedford Square,

London, W.C.1.,

who will send you the names and addresses of those in your Province who can help you further.

Name ....

Canadian Address (where you intend settling)

....

....

Please state what part you have taken in Community Life..

....

Would you like to enlist in Community Service ?

....

What particular phase are you interested in ?

....

....

Any criticism of the material in this pamphlet—especially constructive ideas—will be welcomed at the before-mentioned address.

Tear off at perforation and mail AT ONCE.

THE HOME, SCHOOL & CHURCH

IN

COMMUNITY BUILDING

KHAKI UNIVERSITY OF CANADA

Series 1.—No. 13

1919

THE HOME, SCHOOL, AND CHURCH IN COMMUNITY BUILDING

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In the interests of a Rural Community Life Movement to create Communities throughout Canada wherein the five fundamental social institutions will co-operate in the common task of Character Development and Community Welfare. Such Communities will radiate the Community Spirit which shall finally bind all Communities and Nations together in a World Brotherhood.

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THE HOME, SCHOOL, AND CHURCH IN COMMUNITY BUILDING

I.—THE COUNTRY HOME AND THE COMMUNITY.

Our aim : "To develop character, trained to its greatest capacity and consecrated to the service of home, community and national life in the interests of a world brotherhood and permeated by a deep religious consciousness,and to so improve the conditions of community life that the greatest welfare and happiness may result."

Our slogan : "Let's get together."

In the forefront of all institutions stands the home. No other can compare with it in opportunity for character development. Other organisations are needed to supplement its work in specialised ways, but the home is the unit of and is central in all community life. It has the primary responsibility of direction and control of all other means of character development and community welfare.

A consideration of the home brings us immediately and inevitably to the heart of the whole question—woman and her place and function in the world. Do you realise how all-important woman really is in our home and community life ? The whole home centres on her—she is the home maker—she is the trainer of child character—

the trainer of future community servants—the fusing principle which holds home ogether and gives it its character. Moreover, outside of the home, she provides the warmth of social spirit which does so much to draw the community together. Her point of view is invaluable in such wider community matters as school, church and state. Influencing the thinking of husband and children, and thus indirectly controlling these matters is not enough, she must be able to bring her influence to bear more directly. This duty will require time for, and methods of, securing knowledge of the questions of the day. Questions of school, church and state will never be rightly decided until the common mind decides them and woman's mind is an important part of the common world's mind. Finally, consider her importance on the lowest plane of all—her relation to production on the farm. What would a farmer have to pay to hired help for the milking, separating, churning, choring, cooking, washing and the hundred and one things women do ? All these considerations demand that we pay much more attention to the question than we have in the past. Our task is to discover and remove whatever obstacles prevent her realising herself fully. Conditions in home and community must permit her to make her greatest contribution to family, community and national life.

Before we consider the obstacles in the way of the country woman realising herself in the way suggested above, let us ask—what contribution may we expect the home and family iife to make to community life ? One of the most important is the development of a spirit of co-operation. The country home has a unique opportunity in this regard in that :—

1. All participate in a common task.

2. Co-operative relationship may extend to profit-sharing, and so the interest of rewards strengthens the co-operative spirit.

3. There is co-operative use of the home and its hospitality, training all in simple, sincere, unaffected neighbourliness.

4. The close family relationship gives opportunity for developing the spirit of comradeship. These unique opportunities must be used more widely, or the present day growing economic freedom for individuals will bring a tremendous strain on the rural home.

Besides the unique opportunities to develop a true co-operative spirit in the country home there is another factor in character formation, the power of which is not yet sufficiently realised, viz., the power of suggestion. Psychologists have only recently discovered the powerful influence early childhood experiences have in determining the whole adult life and character of man in body, mind and spirit. Many obscure and apparently incurable diseases, mental and physical, have been traced back by trained alienists to early childhood mental experiences. Drudgery and comparatively small returns for farm labour produce dissatisfaction, and at meal tables and elsewhere suggestions are being continually given by word and deed which discredit farming as an occupation. These suggestions have a cumulative effect on the child which in the end often determines whether he stays on the farm contented and happy or discontented and unhappy, or leaves it for ever. Such suggestions come from parent, teacher, preacher, home-surroundings, fields, roads, schools, churches, and in fact anything discordant that affects any of the child's senses. Can you see the importance of beautiful surroundings, good health, etc. ?

We must realise then, that, while the country home has some unique opportunities, character training is a very complicated matter. Yet, no adequate effort is being made to train real home-makers. We need to be aroused to the necessity for a thorough-going programme of training for motherhood and fatherhood, covering such subjects as food, health, child nature, community life, etc. How shall we arouse the Community to the need ? Who will plan an adequate training programme ? We believe that the will, desire, power and idealism necessary to develop an adequate programme of training and the method of carrying it out, are dormant in the farm women of Canada. The great obstacle in the way of securing the benefit of these dormant powers is the amount of hard work and drudgery in the average farm kitchen in Canada.

If woman is to make the contribution to the world's progress, through the giving of her own time and thought, and through the formation of her children's character as has been suggested above, the obstacle of drudgery must be overcome. The Country Life Commission says: "Woman must have sufficient free time and strength, so that she may serve the Community by participating in its vital affairs." Her time necessarily engaged in the hard physical work, she cannot think about and plan for the training of her children as she should. The Community loses her help and guidance. How many community affairs are badly conducted because of this fact ?

The only remedy is the more widespread adoption of scientific methods of housekeeping, training in domestic science and art, and the introduction of labour-saving devices. Mechanical power must replace the human muscle. Women must be trained to use gasolene and

electric power. Power must be made more readily available. Much more use could be made of power which is to-day installed, e.g., windmills, gas engines, tread power and water power. Farmers must invest more money in homes.

We can do little more here than enumerate the labour-saving devices available now. Provincial Departments of Agriculture all have bulletins dealing with the subject more in detail. Such labour-saving devices cover: (1) Good compact planning of houses for convenience, sanitation, saving of steps, heights of working surfaces, arrangement of kitchen, etc. (2) System and progressiveness in methods. (3) Removing tasks from the home, e.g., creameries and co-operative laundries, etc. (4) General conveniences, such as running water, light, heat, ventilation, bathroom, septic tank, refrigerator, etc. (5) Mechanical conveniences, such as dish-washing machine, knife-cleaner, bread-mixer, stool for working, washing machine, wash-board, mangle, charcoal iron, skirt-board, carpet sweeper, vacuum cleaner, oil stove for summer use, fireless cooker, cement walks to barn and road, etc. All made of the lightest material available consistent with durability.

What about cost? For 800 dollars practically everything mentioned above could be secured. The life of the farmer's wife would be lengthened by several years. A house servant could be secured for only two years for the same sum! Would it not be better to keep the mother alive? Think how much benefit would accrue to the Community from the time gained from drudgery by using labour-saving devices! This subject should be discussed before Farmers' Clubs everywhere.

Besides the removal of the obstacle of drudgery we must place the instruments of positive progress and

culture in the hands of women. Among such instruments are: (1) A good library and current magazines dealing with woman's affairs. (2) More musical instruments and opportunity to learn how to use them. (3) Pictures and games for the home. (4) The beautifying of the home inside and out. Beautiful home surroundings of flowers, shrubs, trees, and lawn are intimately connected with relief from drudgery, satisfaction in life, character formation and responsibility to the Community. Much can be done at little expense by availing oneself of the service offered by the Department of Agriculture of your Province. (5) Sanitation, garbage, and sewage disposal. Country life can never be satisfactory until more attention is paid to all of these subjects.

A word now on the relation of the home to the Community. Warren H. Wilson says. "The Community is the larger social whole outside the household." When we consider questions of disease, contagion, feeblemindedness, immorality, bad roads, education that does not fit for life, false religious teaching, unjust legislation, conscription, war, etc., and their effects, we realise that responsibility does not and cannot end at the fence surrounding the farm. As long as we refuse to accept the full responsibilities and duties of responsible government—so long will such social diseases continue. Only as we inform, train, and give ourselves to the working out of thorough democratic government will these questions be solved.

"The relationship of social questions to citizenship lies at the root of all social problems. We do not recognise as we should that social progress is governed by the measure of responsibility we attach to citizenship. Without community consciousness social progress is impossible. To be interested in housing, playgrounds, hospitals, and schools is not meritorious, confers no

virtue ; such services are implied in citizenship."— *G. Frank Beer*, Toronto. Community life is one unit, and not a series of units independent of each other, called home, school, church, etc. We must understand, appreciate and give largely of our time, thought and effort in improving schools, churches, local organisations, roads, health laws, scientific farming, housing, recreation, etc. None of these questions will be properly adjusted until we get the Community thinking them out together and directing their course. Women must be brought into this Community effort more than in the past. The proper equipment of the home will go a long way to bring this condition of affairs to pass.

QUESTIONS ON THE COUNTRY HOME AND THE COMMUNITY.

1. Are the farmhouses in your home neighbourhood as good as they should be under existing conditions ?
2. In what respect are home improvements needed ? In what respect are home conditions to be commended ?
3. What effect will the large employment of women during the war have on the home ?
4. What is the purpose of marriage and home life ?
5. What improvements could be made in preparing young men and young women for parentage ?
6. How would you suggest that such improvements be carried out ?
7. What contribution does or should a woman make to family, community and national life ?
8. What obstacles stand in the way of the woman on the farm making her greatest contribution to family, community and national life ?
9. Can the farmer afford to buy labour-saving devices for the home ? Can he afford not to buy them ?

10. What advantages has the country home over the city flat in training character ?
11. Have you ever witnessed the power of suggestion in your own life ? Give examples.
12. In what way is the home related to and interested in things that happen outside the farm ? Make a list of the most important.
13. Resolved, that the homestead should be granted to the wife and mother on the conditions that she should grant the husband a monthly allowance.
14. Resolved, that a woman's place is in her own home.

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II.—THE COUNTRY SCHOOL AND THE COMMUNITY.

Our slogan : "Let's get together."

The school ought to educate the whole community for socially efficient country life.

"The new conception of education is to so organise the schools, as to reach all the people who need inspiration and assistance to surmount the high and difficult places in life, and thereby extend to them the real blessings of a democratic Government."—*Foght.*

"The main single deficiency is, of course, lack of the proper kind of education—Everywhere there is a demand that education have relation to living, that the schools should express the daily life."—*Country Life Commission.*

The school, is, potentially, probably the most powerful institution for the ushering in of Democracy. Yet how inadequately we realise that fact ! In simple pioneer days it was sufficient to teach the simple three R's. During the past 25 years so much scientific information regarding agriculture and country life has been accumulated ; social, economic and other conditions have so changed ; life has become so complex that we ought to consider very carefully our rural school system to see whether it is meeting the present-day needs.

Does our present day rural school offer us reasonable hope of performing the task assigned to it above ?

Every returning soldier should be interested in this question and know where improvement can be made. It will be the object of this chapter to point out where improvements can be made. It will conclude by outlining briefly the method which has been widely adopted elsewhere to meet the same conditions as we face to-day.

ORGANISATION AND ADMINISTRATION.

The Unit.—There are many units of organisation, but the commonest in Canada to-day is the district. It was first adopted in New England to meet the conditions of groups of pioneer families more or less isolated. The idea was to place a school within walking distance of every child. The territory ranging from two to four miles across, may contain anywhere from 15 to 40 families. New England, the first to establish, was the first to abolish the "district" unit and adopt the larger unit, the "township," which corresponds to the "municipality" in the West. The township unit has since then been adopted by many States as being more satisfactory than the district. In the Southern States, owing to sparse population, a wider unit, the "county," has been adopted. In Canada the various provinces, in addition to the district system, have recognised a wider unit for taxation and administration through their Provincial Departments of Education, Grants and Inspection system, and the Standardisation of Schools, Courses, Equipment, and Teachers. We are more immediately concerned here with the smallest local unit, the district. What effect does it have on our schools and education? Is

it the most efficient unit ? What is likely to be the effect on the efficiency of the teaching in our schools in view of the following conditions ? Would these conditions be improved by a larger unit ? (1) Because of depopulation, the number of children in a district is small, and in some cases too small. In one Ontario school, only three boys (all brothers) were enrolled ; in another case there were no girls and only one boy was enrolled. Like cases are numerous. (2) Little local jealousies hinder progress. (3) Some sections are indifferent towards education. (4) Parsimony. (5) Taxes and educational opportunity are not equalised. In Saskatchewan in districts of one municipality the tax varied from 1 to 15 mills, and the assessment from a few hundred dollars to many hundreds of thousands of dollars. (6) Supervision of new, inexperienced teachers is very difficult because of the number of schools and the mileage covered by each inspector. (7) There is a scarcity of men with temperament, training and vision to make good trustees. (8) The teacher has from 10 to 34 recitations daily. In one survey it averaged 22 with only 10 minutes each.

Supervision.—Much greater efficiency could be secured if ratepayers recognised the value of this factor more. The inspector, at present, has so many teachers to supervise that he cannot give the necessary time to coaching the inexperienced teachers in their class-work and helping all in the wider work of community leadership. He does not get the time to become the rural life expert that he should be.

Support.—These improvements will, of course, require greater financial support. To-day only one-third to one-half as much is spent on rural schools as on urban schools. Is it fair to country boys and girls ?

THE TEACHER.

Of all factors in the rural school situation, the teacher is the most important. He can make or mar the whole thing. We must as ratepayers secure, whenever possible, teachers of the kind described by a leading farmer who said "Send us a teacher who has some comprehension of rural life and its needs, and is willing to settle down as one of us and help solve our problems. He must be cultured and practical, and *above everything else*, understand that many of his opportunities for good in the Community lie outside the four walls of the school." The good teacher will be a community leader, live in the Community, love country life, have a compelling vision of its possibilities and have the training and necessary self-confidence to realise some of them.

When Denmark in 1846 lay prostrate and impoverished, her teachers, preachers and philosophers remade her schools and revitalised the nation's entire national life. Canada of the future calls on her teachers for no less a task. Have the teachers in your own home schools to-day the training for such a task?

The present facilities for training teachers are good. Normal Schools are developing special Rural Life Departments with school gardens and agriculture. Much valuable work is being done at Agricultural Colleges through Summer School Work, where teachers are inspired for this special work. It ought to be our aim to see that every rural school teacher has some special training for their work and send them to such short courses whenever possible. The training of our children must not be in the hands of any but the best trained teachers possible to secure.

Tenure.—One of the features working against teacher efficiency is the length of tenure of office. The

average length a teacher stays in a rural school is under two years. In a recent Ontario Survey, one boy was found who had had eight different teachers up to entrance and then failed. Is it any wonder ? Another school had had eight teachers in two years. If we want to develop social efficiency we must devise some method of holding a teacher longer. The remedy is largely in your hands, as you will see when you examine the four main reasons for this condition: (1) *Low Salary.* (2) *The Social Standing* given to the teacher and the community's estimation of his va'ue are not as high as they ought to be when one considers his importance. (3) *Difficulty of Securing a Home.*—Farm families to-day usually do not want to be bothered, and so the teacher often cannot secure a suitable home in the Community. (4) With the *Small Numbers* the teacher soon loses all inspiration and leaves for the town or city school, where large numbers beget more enthusiasm.

SOME CONDITIONS UNDER WHICH RURAL SCHOOLS LABOUR.

Besides the matters of organisation and teachers, there are certain physical conditions of pupils, buildings and equipment, which may help or hinder in securing efficiency in the educational system. These conditions have been laid bare in recent years through various Medical Inspections of Rural School Children which have been conducted. Recently the survey of 18 rural schools in an Ontario township revealed the following conditions: (1) *Ventilation.*—None had any system of ventilation except doors and windows; one had sheets of glass inserted inside the

windows so as to prevent draughts when the windows were opened. How much money were the rate payers throwing away owing to the listlessness of pupils in the vitiated air ? (2) *Heat.*—None had jacketed stoves—all were open box stoves with the usual overheating of those near the stove and the freezing of those away from it. How much was the time lost from ill-health (caused by this condition) worth ? (3) *Light.*—Only one school had lighting from one side—all the rest had cross lights. Fifty per cent. were too dark. These conditions resulted in eye strain in every school. In one school, only two scholars had normal eyesight and they had just recently come to the section, i.e., every pupil who went to that school was certain to suffer from eye strain. In one case a girl, 14 years old, was in Book 1 and had been there for years, and her sister, 10 years old, was in Senior 3. On examination, it was found that the former was not "stupid" but that she could not see at three feet what the latter could see at 20 feet. Result—eyeglasses secured—girl's first exclamation, "Why mother, I'll have to learn to know you all over again." Will modern civilisation ever learn the lesson of community responsibility ? (4) *Water.*—Fifty per cent. of the supplies were declared poor. None used individual cups ; all had common dippers and open buckets. Just after the inspection measles broke out in one school and infected 29 families, causing three deaths. What is the connection ? (5) *Seats.*—Only two schools had single seats ; none were adjustable ; all were arranged with lowest seats to the front. Do you wish your child from a well-cared-for home to sit next to one from a poor, unsanitary home ? Is it right to compel children to sit in postures that ruin their chances for health, for lack of adjustment of seats ?

With the traditional arrangement of seats, that fourteen-year old girl with poor eyesight mentioned above, the older she got, the further from the board she would have to sit, thus emphasising her failing. Seats should be adjusted to the user, and arranged in rows of equal sizes, the lowest row next the window. (6) There were no *washing facilities* for children's faces and hands. (7) When children arrived with *cold, wet feet*, it took a long time to warm up to a condition where they could be taught efficiently. (8) No facilities were present for serving a *hot lunch.* (9) Some of the schools were *scrubbed* "*once a year*"—dry swept just before school, with attendant *dust-laden air!* (10) Most of *the grounds* were of fair proportions, with one or two exceptions, where the children had only the road to play on. Not one school had any *play equipment*; none of the teachers supervised the play. Our best play leaders say, that play is the greatest ally that a teacher can have in building character. Why don't we use it more in education? (11) *Outhouses.*—Fifty per cent. were unsanitary; 75 per cent. were offensive in odour and in some cases boys' and girls' places were alongside each other, in others no screening for privacy was provided. What effect are such places having on the moral characters of our children? (12) Enough was observed to indicate that we have a considerable problem of *feeble-mindedness* facing us which may become a menace. (13) Along with all these conditions there was about 80 per cent. of the children who had some medical defect of eyesight, adenoids, tonsils, hearing, malnutrition, teeth, etc. "How can we ever build an A1 Nation and Democracy out of C3 children?"—*Lloyd George.*

CURRICULUM.

If we are "to educate our communities for social efficiency, we must," as Foght says, "eliminate all materials no longer serving a useful purpose ; we must freely introduce new materials required to meet the conception of modern rural education ; we must re-adjust whatever is retained of the traditional subject material to meet the new demands." Not "good mental discipline," but "vital purpose" must be our standard of judging a subject.

Attention must be paid in our curriculum to: (1) *Physical Training*, which modern educationalists now recognise as fundamental. We must make more room for athletics and play. (2) *Health and Sanitation.*—We must devise some means of transforming our teachings into action in better physical conditions of the school, habits of cleanliness, care of teeth, home, and community sanitation. The "hot lunch" offers the opportunity on food lines ; "clean-up days" for community sanitation ; care of the schoolroom and outhouses as an ideal for home sanitation. The formation amongst the children of a Progress Club for School Improvement is also recommended for the purpose of forming habits of cleanliness, system, and order. Consult your Provincial Department of Education regarding them. (3) *Tool Subjects.*—These include reading, language study, spelling and arithmetic, and are only "means" or "tools" for securing further results. The subject matter for these studies is becoming increasingly related to rural life and experience. It is becoming more concrete, and deals with the objects the child handles, e.g., garden, nature

study, home operations, etc. For instance, a composition on "Birds that I know" correlates nature, natural history, geography, agriculture, language st dy, spelling, writing, etc., and at the same time deals with familiar objects. We must all be interested in improving our schools by the introduction of such subject-matter. (4) *Geography.* (5) *History.*—Which deals with "motive" rather than a mere tabulation of dates. (6) *Subjects relating to Life,* such as agriculture, manual training and domestic science taught by the concrete objective method of school gardens and home projects. (7) *Cultural.*—Of course we must still have and enlarge our emphasis on cultural subjects that teach our children to appreciate the richness, breadth, and depth of life, such as poetry, art, music, etc. (8) *Civics,* through the concrete study of such community problems as roads, bridges, fence and concession lines, police, council, drainage, public health, etc. (9) *Economics.*—Unless the future youth of our country are initiated into the intricacies of economic law we can never hope to set up a successful Democracy. (10) *The Aesthetic Element* must be given opportunity for development through the provision of beautiful environment in schoolroom, playground, roadsides, homes, and churches.

" It is well to have in mind that education founded on real life purposes is the most genuinely cultural of all education."—Report of Saskatchewan Educational Survey.

Do you begin to see the possibilities of our rural schools ? Are such things feasible ?

EQUIPMENT.

In order to make such a programme possible certain equipment will be necessary.

Buildings must be large, commodious, modern,

sanitary, and attractive in every way. The factors outlined above under "Some Conditions" must be kept in mind when building.

Grounds should be large enough to provide play space, garden plot, shed room, etc. They should also be equipped with essential play apparatus such as sand-box, swings, balls, bats, school gardens, experimental plots, horse sheds.

Internal Decorating should be artistic (not necessarily expensive), with tinted walls, a few good pictures and plaster casts tastefully arranged, a musical instrument, and a small, accessible library of books relating to country life.

COMMUNITY RELATIONSHIPS.

Why ?—When we consider the amount of money invested in our educational system in the way of buildings and equipment, we must feel that it might return much greater dividends than it does now. It will depend on you as ratepayers whether this larger return is secured. To show why and how this might be carried out will be our next endeavour. It ought to be more widely used because: (1) The school is responsible for educating the whole community—otherwise it will be difficult to get the results of modern investigation and discovery to those beyond school age. (2) The money is already invested and is only being used a very small portion of the day. (3) One of the most immediate needs of rural life is a social centre—here, in the school, it is ready made. "Let's Get Together." Very little planning and extra expense would equip it for community uses, by having such equipment as movable desks, hardwood floor, platform, etc. In putting up new buildings no extra expense would be entailed—only a little careful planning.

How ?—The uses it could be put to might include

Literary and Debating Society, Extension Lectures, Library, etc. Home and school would be brought closer together in their mutual task of character training through frequent meetings of teachers and parents to discuss common problems such as truancy, punctuality, child nature, health, etc. All of these avenues of service would open the way for the teacher to his highest place of service in the Community in the capacity of a Community Leader.

THE HOUR OF TRANSITION.

Many one-roomed schools are meeting and overcoming these problems and conditions. Much is being accomplished by Departments of Education through a higher standardisation of schools; but at the best, the one-roomed rural school will only be an improved pioneer school. We can never in the district school system get over the difficulty of lack of numbers and the attendant impossibility of training in team work or co-operation. The changed conditions in rural life in the United States and Canada, have evolved a reorganised Rural Community Life School which is known as the Consolidated School. It is simply two to eight district schools combined in one large centralised building with better graded classes, children conveyed from outlying farms in vans, and a curriculum and method adapted to Rural Life. Over 11,000 have been established in the United States of America, over 70 are now found in Manitoba. So that the possibilities of this new type of rural school may be realised, we treat the subject in somewhat more detailed form here.

CONSOLIDATION OF RURAL SCHOOLS.

Difficulties.—The first thing that will arise in your mind will be the difficulties in the way. Let us examine

some of them. (1) *Cost.* If we are content to have the same grade of education, consolidation will cost less ; if we demand increased efficiency, as we ought to, it will cost more money, but cost less for each day's teaching per pupil, because in practice it is found that more pupils are enrolled and the average attendance is much higher. (2) *Tradition* of the "Old Red School House" stands in the way. (3) *Prejudice*—in advance of trial. (4) *Roads* too bad ; *weather* too severe. It has proved successful in Manitoba in the severest weather—some schools never missing a single van trip in years. It has proved successful in States where road conditions were as bad as any in Canada. Besides, milk routes, rural free mail delivery and other social duties are kept up, in spite of the bad roads. If you can carry your mail—why not your children ? (5) *Difficulty in getting Drivers.* Others have never failed, why should we ? (6) *Danger to Morals* in covered vans. What about the moral dangers on the road to school, to-day—unsupervised ? The van would be under careful supervision at all times, and under school discipline. (7) *Children too long on the Road.* The time need not exceed $1\frac{1}{4}$ hours ; no longer than some are on the road under the present system. (8) *Land Values* would depreciate. According to experience, they have increased because of consolidation. As a matter of fact, every difficulty you bring up, has been faced and overcome hundreds of times before. The experimental stage in consolidation is past.

Advantages.—Let us enumerate the advantages that those who have had experience with the system are unanimous in advancing for consolidation. (1) *Administration.* The management of the school is simplified : fewer recitations, taxation and educational opportunities

are more equalised, cost per teaching day per pupil is cut in half, and earning power of pupils increased by the new method. Expert supervision is much simpler with fewer teachers and schools to be covered, closer grading of pupils is possible, enrolment is larger (chiefly of those over 14 years), average attendance jumps from 50 per cent. to 75 per cent., pupils arrive at school more punctually. (2) *Teachers* have higher salaries; specially built homes on school grounds and, in consequence, stay longer in the one school. With these advantages more married men are attracted, and consequently more mature leadership is furnished. The teachers may be specialists in agriculture, domestic service and community life problems. Fewer teachers being needed, there is more chance for securing those with country life sympathies. (3) *The Pupils*, riding to school, arrive warm; avoid wet clothes and feet, and so have better health. Owing to the more attractive methods and curriculum, they stay in school longer. The presence of many others of their own age stimulates their development; they secure better co-operative and social training and experience which culminates in the development of local leadership and personality, which is our community aim. Truancy is greatly reduced; the moral tone of child life raised; school and community pride and spirit are developed. (4) *The Curriculum* is adapted to life in matter and method. (5) A consideration of the advantages already enumerated will convince us that we have *a better school.* (6) *The Teaching Equipment* is much better than it is possible to have under the district system, including as it does agricultural, manual training, and domestic science laboratories; from five to ten acres of grounds equipped for play, gardens, experimental plots, etc. It is also

possible to have ideal conditions of light, heat, ventilation, water, sanitation, etc. (7) Such a school is *a real Rural Community Life School* adapting itself to life conditions, offering in many cases a High School education to farmers' boys and girls, without taking them from home, reaching out still further to the older members of the Community through short courses, experimental work, and night schools. Around the school are beautiful grounds which become the centre for picnics and holiday celebrations. On winter evenings the auditorium becomes the Community social centre, to which the school van bring the adults for all kinds of gatherings, thus overcoming isolation—the great drawback of rural life. In the train of the movement come good roads and the growth of a vigorous community spirit and pride.

Wider Advantages.—When we have said all that, we have not said all that can be said in the favour of consolidation. We believe that the consolidated school area offers the ideal area for other organisations. (1) *Political.*—It embraces these people who form the unit of political organisation, including in groups those who have the largest range of common interests, whereas the present arbitrary political divisions throw together little chopped off sections of many communities. (2) *Economic.*—It includes almost the ideal number of farmers who can get to know each other intimately enough to develop confidence in each other for economic co-operation. (3) *Social.*—Distances are such and the road system so developed as to encourage many get-together activities. (4) *Religious.*—The territory and population is of the right proportions to employ one good, country-life clergyman in the organising of one good, strong church. (5) It is large enough to bury some of the annoying petty

jealousies of the district system. (6) The professional leaders, teachers, preachers, etc.—are centralised and stable in tenure.

"In the enlarged sphere of this recentered country life new and larger things become possible along many lines"—*Willet M. Hays*, Assistant Secretary, Department of Agriculture, Washington.

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QUESTIONS ON THE COUNTRY SCHOOL.

1. Is the unit of school administration large enough ?
2. Why should we tax Township, County, Provinces, and Dominion for educational purposes ?
3. "Equal rights for all." Is the country boy or girl getting the equal of the city boy or girl in education to-day ? Is it fair ? Is it possible to give them the equal ? How ?
4. How many farm boys in the group have graduated from High School ? Why ?
5. Do we spend as much money on our rural educational system as we should ?
6. What qualifications would you require in a teacher if you were a Trustee hiring one ?
7. Why should rural teachers be specially prepared and trained ? And how ?
8. Why do teachers remain such a short time in rural schools ? How can you remedy the situation ?

9. Is your home school satisfactory as to ventilation, heat, light, water, seating, washing facilities, hot lunch, cleanliness, playground and equipment, and outhouses ?

10. Have you ever had medical inspection at your home school ? If so, what was the result ?

11. Should medical inspection be compulsory ? Why ?

12. Do the schools in your home neighbourhood provide the kind of instruction required to keep the people in the enjoyment of good health and sanitary surroundings ? Do they fit them to earn a remunerative living ? Do they train them to become useful, happy, responsible members of the community ? Do they train them to make the best use of their leisure hours ?

13. Is your home neighbourhood school used for any other purpose than teaching children ? If so what ? Why should it be more widely used ?

14. Make a list of the things you think you could do in your community if you had the use of the school.

15. Which of these things have you made up your mind to carry out when you return ?

16. What is consolidation of rural schools ? What are its advantages to the community ?

17. Resolved that the school is not the place in which to give agricultural education.

18. Resolved that a high school education is more to a boy than a half section of improved land.

III.—THE COUNTRY CHURCH AND THE COMMUNITY.

Our slogan : "Let's get together."

The task of the Church is the maintenance of high Christian ideals in all concerns of life, personal, community, national and international. It is the specialised institution for the purpose of securing men's acknowledgment of and allegiance to the Kingdom and reign of God in the physical, social, spiritual, economic, political, and industrial affairs of life.

"We miss the heart of the problem if we neglect to foster personal character and neighbourhood righteousness. The whole people should understand that it is vitally important to stand behind the rural church and help it to become a great power in developing concrete country life ideals. . . . This is not only because in the last analysis the country life problem is a moral problem, or that in the best development of the individual the great motives are religious and spiritual, but because from the purely sociological point of view, the church is fundamentally a necessary institution in country life. . . . The rural church must be more completely than now a social centre. This means not so much a place for holding social gatherings, although this is legitimate and desirable, but a place where constantly emanates influences that go to build up the moral and spiritual tone of the whole community." —*Country Life Commission.* Thus emphatically do

great rural life leaders in America place the Church and what she stands for at the heart of Community life. How is she answering the challenge ? Is she well equipped for the task ? It is the purpose of the chapter to outline briefly the situation as it is in Canada to-day—some of its problems—some of its needs—and some suggestions about future developments. First, let us consider very briefly the present conditions. Owing to the same social and economic changes that have affected the school, the church faces great problems of readjustment. Depopulation has had its effect on church membership—in decrease of numbers, withdrawal of leadership and financial weakness. The same pioneer conditions that produced the district school produced the circuit system of small preaching appointments with non-resident ministers, which have grown, in many cases, into circuits of small struggling churches. Intense individualism has developed sectarianism to the point where many rural communities have too many churches. Conservatism stands in the way of adopting new methods. These conditions and others have created the situation to-day where we have many small fields, inadequately supported, overchurched, lack of enthusiasm and shortage of leadership. We are passing through a time of transition. Here and there the country church is rising valiantly and re-adjusting herself to the great task she has before her. Wherever she has had her greatest success, it has generally been because of the following principles.

VISION.

A New Kingdom.—The country church is realising in these days, as never before, that it is not enough to work for saving individuals out of the conditions of modern

society, she must save society itself, that her spirit must permeate the Community social ideals as well as personal ideals. As this vision grows clearer two things are becoming more evident—that (1) All the sciences are the Church's handmaids. Science after all is thinking God's thoughts after Him. (2) Community service must be the objective—the Church must apply its teaching to every phase of life and create ideals for social, economic, and all other phases of life. Service rather than mere assent to doctrine must be the measure of faithful membership. "Religion that does not enter into everyday life and enrich the baffling experiences of daily labour with great spiritual interpretations, gives little of value to country people."—*Groves.*

THE CLERGYMAN.

As the teacher is the key to school readjustment, so the clergyman is to church readjustment. Leadership is the greatest need. It must be resident leadership—no man who comes in from outside can ever be truly effective. They will be leaders in many Community concerns outside of their churches. Outside of Christian character, probably no qualification is so important as the ability to recognise leadership in others and to organise it in Community service. Finally, the task must be looked upon as a life-work—not a stepping-stone. The country church is a life-work which calls for the strongest and best men of the nation. The problem fairly bristles with all sorts of intricate questions upon which the church must take a stand. The call comes to-day for young men of power to invest their lives in this the greatest of all rural-life callings. The call is timely, because there is no problem of post-war reconstruction that is so urgent. What shall it profit

a farmer if he realise the greatest returns from his farm if in doing so he loses his best character ? Does the pioneer call appeal to you ? Read Beard's "Life of John Frederick Oberlin," and learn how one young man entered and completely revolutionised the social, educational, religious, and economic life of a small, rural Community in the Vosges mountains. Such tasks are waiting by the hundred for men who have the vision and consecration for the task. The country-life movement calls for you to dedicate your life to the country church if you love the country. Will you be one who answers, "Here am I, send me ?"

Training.—The man who answers the call ought to get special training. Farmers and their families to-day are being scientifically trained as never before—so the clergyman must have a scientific outlook on life. His training will cover country problems of home, school, and Community. Much worth-while information can be secured by studying the literature of the movement, by reviewing surveys that have been made, by attendance at Community Life Institutes, as run by the Rural Community Life Movement of Ontario (see "The State, Business Organisation and other Factors in Community Building"), by attendance at church conferences, and especially by attendance at the Summer School for Rural Leadership held at MacDonald College, St. Anne's, Quebec, at Ontario Agricultural College, Guelph, Ontario, at Manitoba Agricultural College, Winnipeg, Manitoba, every summer. Every clergyman should attend something of the kind every year for inspiration. Scholarships for attendance at the Guelph Summer School are now available for Ontario residents. Interest yourself in seeing that your clergyman has a chance to attend such gatherings.

PROGRAMME.

The Church, as was said in introducing this chapter, is essential to the best satisfaction in life. If she is to secure her greatest success it will only be as we enter into her life and work whole-heartedly for her. If we have any criticism of her work, let us give it in a constructive way as members within her ranks, and not as critics who sit outside and merely find fault. She has a great mission to fulfil, but she can never accomplish it without our whole-hearted co-operation. Let us review briefly her task so that we may appreciate her appeal more and find our place in her service to the community.

1. **Preaching and Worshipping.**—The main purpose of this service is the setting up of high ideals and the spiritual interpretation of the farmer's everyday life. The country clergyman pictures God and man as co-partners. He shows Him standing behind the plough and lending His aid to the farmer through the laws of chemistry, bacteriology, etc. He pictures Him behind the beauty and harmony of the landscape. Nowhere are special days such as Children's Day, Easter, Thanksgiving, Christmas, etc., fraught with such meaning. From these services emanates the spirit which controls all life's affairs, lifts the load off tired hearts, refreshes and strengthens us for a new week of victory over trying experiences and temptations, and so man's soul is strengthened and ennobled.

2. Undoubtedly the greatest task facing the Church to-day is **Religious Education.** So to train character that life in a democracy will be a religious experience is a task calling for the highest capabilities. The teaching of a positive morality and religion is needed. "The age of prohibition as an expression of ideals is past."—

Groves. **If the possibilities are to be realised, we must** give ourselves to the task. We must assist the professional leaders of our own church to organise our Sunday Schools thoroughly, introduce graded lessons, use modern methods, and train leaders, etc.

3. **The Church is an Army** enlisted to bring in the reign of righteousness in all realms of community life. Are you enlisted in its ranks ? If we are true members of the Christian Church we will not be content with endorsing recreation, but will see that it is provided ; we will demand medical inspection of school children, consolidation of schools, good roads, and everything else that is of service to the Community. Such progress is the logical outcome of the interest of the members of the Church in the Community.

4. **Marginal Folk.**—The Church's greatest aim is to serve those who are the neediest—the unscientific farmer through the ministry of science, the poor through love, the immigrant through training in citizenship, the tenant through organisation for business, the sick through improving health conditions and rendering sickness impossible, and in short all who are having a hard struggle to make a living. Dr. Wilson calls such "the marginal folk." These classes fix the standard of morals for the Community—let us heartily sympathise with and help in the Church's efforts to minister to their needs.

5. The land will ultimately pass into the hands of those who can use it best. Will those men be Christian in character ? It is in the interests of the Church to **Promote Scientific Farming** among her members. For that reason the Country Church to-day promotes or encourages lecture courses, etc., in the Community to hasten the age of scientific husbandry.

6. In this age of measuring everything in terms of

cash, one of the greatest services the Church renders the Community is to **promote the giving spirit** among farmers. They are encouraged in a concrete way to give generously. The necessity of community welfare is urged, a programme is outlined requiring money expenditure, such as play equipment, increased educational facilities, good roads, libraries, Community halls, etc. This duty is one of the most important of the Church's tasks, and offers the greatest opportunities for character development. We must stand behind her in her endeavours to secure the consecration of wealth to Community improvement. The above programme is not mere theory, it is being carried out by hundreds of country churches in the land to-day, and brave beginnings at splendid programmes have been undertaken by churches that still suffer from inadequate plant.

BUILDINGS AND EQUIPMENT.

At this point we meet with the question of equipment. The pioneer church had only a few duties—to preach, to marry, and to bury—hence the simple one-roomed building with fixed pews sufficed. To-day the demands are many and varied if Community service is to be the objective. The Church, to express the modern conception of religion, the "life abundant," must be equipped not only with auditorium for church services, but with grounds and play equipment, Sunday-school rooms, club rooms, lecture rooms, reading and rest rooms, cloakroom, stage or platform, kitchen, folding-chairs, children's nursery with cots, so that young mothers may go to church. How all these features may be simply combined in inexpensive church buildings is well told in "The New Country Church Building" (Brunner). "No building is truly beautiful, whatever

its style, which is not useful—it is also true that no church building is completely useful, which does not in the strength and dignity of design, minister to the æsthetic taste and satisfaction of the worshippers."—*Brunner.*

RELATION TO COMMUNITY.

In conclusion, let us consider briefly what the relationship of the church is to the Community. That relationship will cover :—

1. **The Community Life** as a whole. This co-operative spirit is being developed in some rural districts by holding annually one service in the interests of each organisation, such as a Health Day in co-operation with the Local Board of Health, a School Day with the School Teachers and Trustees, a Farmers' Club Day with the officers present, and so on.

2. The inspiration and assistance in the **establishing of a Social Centre and a Federation of social forces** for Community welfare.

3. **The Home**, by visitation, promotion of home parties, combined cottage prayer-meetings and socials, the organisation of a Home, School, and Church Association for the consideration of Child Welfare, promotion of an Old Home Week-end for family re-unions, the encouragement of the Family Altar, etc.

4. **The School**, by setting up high ideals of Christian education through special day sermons and lectures. Christianity itself depends on trained intelligence. so we must be alert to modern educational methods and ideals. The teacher and his calling should be magnified before the Community. Where previously it was difficult to secure some service for

church members, here, with the wider vision of the Kingdom, tasks abound—trusteeship, school improvement, consolidation, night-school work, medical inspection, etc.—the providing of any one of these is a Christian's task not as a virtue, but as a social obligation.

5. **Farmers' and Women's Organisations** by inspiring some of her keenest and best workers to get into the work of organisation.

6. **The State** through Literary and Debating Societies discovering and training the men who will govern our country in future years.

The Country Life Movement in Canada calls for your service, whether as a layman or a clergyman, to promote the interests of the country church for the future welfare of Canada. Can we count on you as you go back into your old home Community ?

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QUESTIONS ON THE COUNTRY CHURCH.

1. Why is the Church an absolute essential in country life ?
2. How many preaching points has your home clergyman ? How many miles does he have to travel in order to visit them all ? How many other clergymen cover the same territory ?
3. What does the Kingdom of God mean to you ?

4. "Service rather than mere assent to doctrine must be the measure of faithful church membership." Do you agree with this statement ?
5. Why is church co-operation more hopeful in the solution of the rural problem than immediate federation ? Is there an urgent need for unity of action in this matter ? How may it be secured ?
6. How does your home church serve the community ?
7. What classes in the Community need the ministry of the church most ? Why ?
8. Why should the Church be interested in the spread of scientific agriculture in all its phases ?
9. Is your home Church suitable in equipment for the varied programme called for to-day ? What additions and improvements are necessary ?
10. What service can you personally render the Church when you return ? Register a vow now to give yourself to that work on your return home. Begin training for it now !
11. Resolved, that students for the Country Ministry should take a course in agriculture.
12. Resolved, that unity of church plans is essential to effectual Community work in rural districts.

If you are interested in this matter and would like to be put in touch with those who are promoting its interests in Canada, please fill out the attached form and mail to :—

A. MACLAREN,
DEPARTMENT OF AGRICULTURE,
Khaki University of Canada,
31, Bedford Square,
London, W.C. 1,

who will send you the names and addresses of those in your Province who can help you further.

Name...

Canadian Address (where you intend settling)

....

....

Please state what part you have taken in Community

Life...

....

Would you like to enlist in Community Service ?

....

What particular phase are you interested in ?

....

....

Any criticism of the material in this pamphlet—especially constructive ideas—will be welcomed at the before-mentioned address.

Tear off at perforation and mail AT ONCE.

THE STATE, BUSINESS ORGANISATION, AND OTHER FACTORS IN COMMUNITY BUILDING

KHAKI UNIVERSITY OF CANADA

Series 1.—No. 14

1919

THE STATE, BUSINESS ORGANISATION, AND OTHER FACTORS IN COMMUNITY BUILDING

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In the interests of a Rural Community Life Movement, to create Communities throughout Canada wherein the five fundamental social institutions will co-operate in the common task of Character Development and Community Welfare. Such Communities will radiate the Community Spirit which shall finally bind all Communities and Nations together in a World Brotherhood.

PUBLISHED BY THE

KHAKI UNIVERSITY OF CANADA

THE STATE, BUSINESS ORGANISATION, AND OTHER FACTORS IN COMMUNITY BUILDING

I.—THE FARM BUSINESS ORGANISATION AND THE COMMUNITY.

Our slogan: "Let's get together."

The task of Business Organisation is to provide a means whereby men may mutually serve each other, production may be increased, greater returns secured, just distribution of wealth accomplished, economic freedom for all assured; all as a means to the ultimate end of improving community conditions so that the best character, welfare and happiness may be the result.

"Reduce the income of the farm family in America to that of Continental Europe," says President Waters, of Kansas State Agricultural College, "and a peasant class in America will be the inevitable result. If farming is allowed to become unprofitable as compared with other occupations it will be given over to a less efficient race than is now on the farm." Sir Horace Plunkett's watchwords, "Better Farming, Better Business, and Better Living," sum up the solution of the question, but their roots strike much deeper than most people realise. Agricultural Colleges and other agencies until recent years confined themselves to improving

production. and that has not solved the rural life problem. During the last 25 years they have given increasing attention to the question of markets and co-operation, and now we are beginning to feel that there is something beyond that. Now farmers are beginning to feel that there are other factors which affect the returns. For some reason farmers do not receive as good returns as they should. Why? What are the factors that stand in the way of farming being as profitable as it should be? No matter what may be the answer we feel sure that the only remedy is the application of the Community Idea: Co-operation is the answer.

THE PROBLEM OF RETURNS.

In order to show how the Community Idea permeates the whole structure of farm business, let us review some of the problems facing the farmer. How can the farmer secure larger returns, not per acre, but per man or labour unit. We may divide the problem into seven sections:—

1. **Better Farming Technique**, including (*a*) the use of better seed, i.e., seed that yields more heavily, matures early, etc. (*b*) The adaptation of soils, fields, and even communities to the most suitable and productive crops. (*c*) Better methods, such as adoption of rotation of crops, thinning and spraying of fruits, etc. (*d*) Improved marketing methods, e.g., grading and box-packing of fruit. (*e*) Soil improvement by fertilisation, liming, correct cultivation, drainage, manure application, etc. (*f*) Elimination of pests, including plant diseases, weeds and insects, the losses from which may rise as high as 50 per cent. (*g*) Use of the proper machinery. Discrimination must be used in the choice of necessary im-

plements. (*h*) Use of most economical power. (*i*) Better stock. The quality of the stock determines the amount of feed and labour that can be economically expended on them.

2. Assuming that all the most accessible and best land is under cultivation, the next method of increasing returns is **Economising Land.** Here we are faced with three conditions to overcome. (1) Bad physical conditions, including (*a*) stony ground which may call for clearing, improvement of pasture, or reforestation; (*b*) wet or swampy soil which often is very rich in fertility, but requires drainage; (*c*) dry soil calling for either dry farming methods or irrigation. (2) Bad chemical conditions, including (*a*) acid soils, sometimes amenable to liming; (*b*) alkaline soils, calling for flooding, underdrainage, scraping, deep-ploughing, neutralising, mulching, etc. (3) Bad social conditions, such as pertain (*a*) where bad taxation tends to allow lands to become neglected, and (*b*) where speculation holds land out of productive use.

3. **Farm Management.**—Recent surveys reveal the fact that returns are affected by—(1) The size of the farm; the larger farms proving more profitable, partly because of economy of man and horse labour. (2) Knowledge of the capacity of stock to use feed economically. One survey revealed that, while $50.00 worth of feed per year was the maximum that stock of the quality kept in that neighbourhood could use profitably, some farmers were feeding $80.00 to $90.00 worth. (3) Organisation of the factors in production: (*a*) Having the proper quantity, proportion and relationship of labour, capital, land and intelligence invested. The point may easily be reached where it does not pay to invest any more of any one of these factors, e.g., the quantity of feed

fed to the stock under the survey above passed that point when its value exceeded $50.00 ; (*b*) using the proper quality of these factors, e.g., seed, stock, width and make of implements, etc. (4) The kind of records and accounts kept, e.g., cow-testing records invariably reveal cows in the dairy herd which are costing more than they produce. This matter of accounts is very important. Three systems are recommended : (*a*) "The Farmer's Account Book," Commission of Conservation Ottawa ; (*b*) "The Leitch System," A. Leitch, B.S.A., Ontario Agricultural College, Guelph ; (*c*) "The Newman Bates System," Ottawa.

4. **Labour Problem.**—Canadians being a people of democratic spirit, ambitious men become owners and the unambitious are too often useless, and hence we will long have this problem to meet. It will never be overcome until farmers can pay high enough wages to compete with industry, adopt a system whereby labour can be continuously employed the year round, provide conveniences for living, social life and companionship. One method of helping to meet this problem, which is seldom discussed, although important, is the promotion of health measures which will reduce the death rate and the amount of preventable sickness.

5. **Marketing and Co-operation.**—Farming is a very complex business. It calls for very varied skill and knowledge. Many sciences and arts are involved. The farmer is a labourer, a capitalist, a business man, and a salesman, requiring a knowledge of markets and the cost of production. Another factor that complicates the situation is that he deals with specialists, e.g., butchers, etc., who know more about the article the farmer has to sell and its possibilities than he does. He is in a world

market in competition with farmers all over the world. He sells to an organised business world where many unnecessary middlemen exist. The result is that the average small farmer is at a hopeless disadvantage. The only way out is co-operation for economic ends.

6. The objection that the carrying out of some of the above suggestions are prevented because of poor returns from farming, complicates the question, but does not negative the proposition. If our systems of land taxation, etc., have their effect is only means that the farmer has one more field of life to master in order to put his business on the right footing.

7. **Education.**—That the proper education for country life will help farmers to understand the intricacies of the above problems, and train them how to solve them, and thus enlarge their earning capacity, is proved by the figures secured by the Cornell University. Out of 573 farmers interviewed, 398 attended district school only—their labour income averaged $318.00 ; 168 attended High School—average labour income $622.00 ; 10 attended College—average labour income $847.00. Does education pay ?

If you examine the foregoing problems, you will see that organisation and co-operation is the only answer. "Let's get together." "Each for all—all for each." The Community is the vital thing—not the individual. Government co-operation is essential for better seed, experimentation, pest control, drainage, irrigation, farm management surveys, legislation and many other features outlined above. Co-operation between farmers, and even between associations of farmers, is necessary for marketing, etc. "The Danes have a sense that success is not individual, but that it is the common

prosperity of all the members of the community."—*Wilson.* So Canadians must learn that the only success is Community success.

WHY CO-OPERATION IS NECESSARY.

When one considers the conditions in modern marketing to-day, it becomes evident that the Community or Co-operative idea must be adopted by farmers if they are to win out. Co-operation makes possible—

(1) The standardisation of products. The first thing that happens when a group of farmers co-operate is that they learn from each other and their products improve in quality. Then they learn the value, for market purposes, of producing a large bulk of uniform quality and all agree to adopt the one variety of crop and kind or breed of animals. This makes it possible to economise in the cost of manufacture, e.g., creameries; to economise in cost of transportation, e.g., carloads of potatoes of one variety, etc. In the case of a Community adopting one breed, it provides a wider basis for selection in breeding, makes for permanency and continuity, more expensive sires can be secured, etc. The quality being improved, some system of grading is then adopted and better prices secured. These associations usually promote Fairs and Exhibitions, which in their turn stimulate further progress.

(2) The regulation of the quantity marketed so that the market is not glutted. Through storage the produce may be placed on the market at the most favourable time.

(3) Economy in handling, gathering, transportation, etc., of produce, e.g., creameries and their wagons; picking, packing and shipping fruit.

(4) The registration of brands and trade marks which help to distinguish products on the market, e.g., Sunkist oranges.

(5) Advertising the farmer's produce, as was done in Canada a year or two ago in the case of apples, and as is needed to-day in the cheese market.

(6) Buying supplies in large quantities most advantageously. Farmers ought not to be too quick to conclude that middlemen are making large profits. Remember the storekeeper has to provide in his price for keeping stocks on hand, transportation, delivery, store rent, service in store, credit until accounts are paid, selling in convenient bulk, etc.

(7) Securing special markets. The paid manager can look out for new markets, direct the flow of produce to good markets, etc.

(8) All of the things we have spoken about in these three booklets, "Building the Rural Community," "Home, School and Church," and the present one, without co-operation none of them is possible. The better the co-operative spirit, the better are the Home, School, Church, Recreation, etc.

(9) Large drainage, irrigation, and other projects for bringing land under cultivation.

(10) Reform of any detrimental social conditions.

PRINCIPLES OF CO-OPERATION.

It has been proved that before co-operation can be successful the following principles must be observed:—

(1) Good pay for managers The position is one calling for very high qualifications and must be well paid.

(2) One man, one vote; each member must have an equal voice in settling the policy of the association. The one possible exception to this is where the quantity of business done varies very widely between individuals, when the acreage or amount of business done determines voting power.

(3) The unit of organisation must be confined to a restricted area. The men in it must be able to meet each other often and so develop confidence in each other.

(4) The organisation must be born of necessity or it will not survive organised attack and other obstacles which will be met with during its formative years.

(5) Membership agreement must be signed, and breaking of contract penalty must be provided for by fine or damage clauses.

(6) The management must be delegated to a few experienced men and not unduly interfered with.

(7) The individuality of the associations should be preserved in order to stimulate the right spirit.

8) Partisan politics must always be absolutely excluded.

FORMS OF CO-OPERATION.

Various forms of co-operative enterprise have already been tried and proved successful. These cover egg circles, wool marketing, creameries, cheese-factories, bacon factories, slaughtering, fruit, canning, storing, marketing all kinds of produce, buying supplies, insurance against fire, hail, wind, rain, etc., telephone, electric power, laundry, roads, cow-testing associations, breeding, crop improvement, labour, rural credits, banking.

RELATION TO THE COMMUNITY.

"The money consideration is frequently too exclusively emphasised in farm homes. The open country abounds in men and women of the finest ideals; yet it is necessary to say that other ends in life than the making of more money and the getting of more goods are much needed in country districts; and that this more than anything else, will correct the unsatisfying nature of rural life."—*Country Life Commission.* Over and above the idea of moneymaking must stand the ideal or motive for which the money is made, and that must be Community Service and improvement. Money must be invested in—

(1) Roads and other means of communication and thus break down isolation. Democracy is impossible without such investment. The flow of mental ideas and social life thus made possible is the life blood of the Community.

(2) Homes—bringing more conveniences, greater equipment and opportunity for play.

(3) Schools—better taught and equipped.

(4) The Church, so that it may meet its opportunities.

(5) A real dignified and worth-while Community Social Centre.

(6) Recreation and playgrounds.

CO-OPERATION AND ITS EFFECT ON CHARACTER.

Experience in Europe warrants us making the assertion that only as our Business Organisations are built on the Co-operative idea, can we hope to produce as their result the kind of character trained in Community

Service which is the first part of "Our Aim." Competitive business produces the opposite kind and destroys community life. In Europe, co-operation has developed moral character, reliability, sobriety, honesty, thriftiness and brotherliness.

"If I help my neighbour, or make him better off in any way, I do a good turn for him, a better turn for the country, but best of all for myself, for in turn I am sure to reap manyfold."—*Coulter*.

QUESTIONS ON FARM BUSINESS ORGANISATION.

1. What economic causes are responsible for the drift to the City? Will these causes continue to operate?

2. Why are prominent members of Banks, Loan Corporations, Boards of Trade, Grain Exchanges, Railway Companies, etc., so much interested in better farming?

3. Do the farmers in your home neighbourhood get the returns they reasonably should from the sale of the products? If not, how may they secure more?

4. What are the difficulties in the way of successful farmers' Co-operative Societies?

5. What factors limit the amount of food produced?

6. Why is farm labour scarce in Canada? What suggestions have you for increasing the amount of labour?

7. Are the conditions surrounding hired labour satisfactory? How could they be improved?

8. Has a farmer the right to employ a man for only a few months in the year?

9. What improvements could be made in increasing production that would not involve increased expenditure ?
10. What improvement would warrant increased expenditure ?
11. Have you ever kept records of your dairy cows' production ? What were the results ?
12. Does education help a farmer increase his earnings on the farm ?
13. What is meant by saying that success is not an "individual" but a "community" affair ?
14. Why is co-operation necessary ?
15. What forms of business co-operation among farmers are you familiar with ?
16. What is the ultimate object in farming ?
17. "Better rural institutions and more attractive homes and yards will follow an increase in the profitableness of farming." Is this statement correct ?
18. Resolved that production should be for use and not for profit.

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II.—THE STATE AND THE COMMUNITY.

Our slogan : "Let's get together."

The task of the State in a Democracy is to crystallise into law and enforce public opinion concerning the moral relationship of man to man in all realms of life: in the Community, nation and world. It is the Community Will, the Community Executive Power—internal and external.

We have now covered the Community as a whole, and the Home, School, Church and Business Organisation; as specialised institutions within the Community. We have shown how if these institutions are to be successful, they must be permeated by the Community Spirit and Idea. Now we are to consider briefly, the State. If the co-operative spirit is necessary for success in local community institutions, it is much more so in the maintenance of democratic Government. Without perfect co-operation there can be no true harmony—the more perfectly and finely developed the sense of Community of Life and Purpose, the more successful the Government. Here, as before, the most essential thing to gain is the Community viewpoint and spirit.

WHAT IS THE STATE?

Emerson said : "The State cannot be better than its citizens." You will often hear people say, "The Government spends too much money," or "The Government is inefficient," or "The Government is this or that, or should do this or that." Who is the Government? We need continually to remind ourselves that in a Democracy such as we belong to "We are the Government." If it is corrupt, inefficient, indifferent, and extravagant: or

efficient, straight and businesslike, it is simply so because we, the electorate, are so. We are the State. If we are ever tempted to think that the State is indifferent to our rights it would be well for us to ask ourselves how much time and real earnest study we have given to the common affairs of state and the men who represent us in the House of Parliament. There is probably no more difficult problem in Government than how to secure a more thorough understanding, acceptance and fulfilment of the responsibilities and duties of citizenship in a democratic Government. There is need for some method of continuous education of public opinion on public questions. The Community Centre furnishes the opportunity. All partisan ideas must be avoided and all sides of the question discussed must be presented and considered calmly and fairly.

FAR-REACHING NATURE OF GOVERNMENT ACTIVITY.

Modern civilisation is so complex and delicately balanced that the passing of some Bill in the House of Parliament may affect the whole system of national life adversely or favourably. For instance, in these recent war years loud clamours were heard for controlling the price of this or that commodity by law. If this request were acceded to, its effects would be felt through all our economic life, because everything on the market is adjusted in close relationship to that one commodity—if you fix its price you interfere with and disturb all other things on the market, and few can tell what the ultimate effect will be. This is not an argument against price control, but just to indicate how complex the questions of State are and to emphasise how necessary it is that we study and try to understand national questions. It is also meant to show how truly every question

of State is a Community affair and affects every individual in the nation. Statecraft fairly bristles with problems which profoundly affect the material and moral welfare of every person in the Community. Among these questions are the system of land laws and tenure, public ownership, woman suffrage, international relationships, taxation, system of parliamentary representation, etc.

SOME FIELDS OF STATE ENDEAVOUR.

The way in which the Community Idea permeates the whole fabric of State is at once seen when we consider the work it undertakes and how it affects the life of individuals in the State. Take, for instance, the question of good roads and their influence in reducing cost of marketing produce, increasing opportunities for social intercourse. This question affects every individual and determines whether he will have the opportunity for developing a wide, rich, abundant life or not. Then again other means of communication, viz., telephone, trolley, rural free mail, parcels post, etc., widen the life. And so it is with a multitude of questions—the right policy opens the way for the "abundant" life; the wrong policy cramps life. So we must study the national policy in such questions as land tenure, land settlement, immigration, irrigation, conservation of natural resources of water, mine, forest, field and sea, taxation, recreation, police, health, medical inspection of school children, feeblemindedness, education, etc., etc., because every one of them affects every individual in the Community. The more nearly we can secure the best judgment of *every* person in the Community on these questions, the more nearly correct will be our policy. In other words, they are Community questions requiring Community judgment.

THE CONTRIBUTION OF THE RURAL MIND.

Whatever other conclusion we arrive at, we must come to realise that it is absolutely essential to a healthy national life that farmers and rural folk in general bring their contributions to the question of government. They have a contribution to make that is needed. Their social experience has been entirely different from city people. All their lives they have struggled with Nature. They have learned that you cannot manipulate natural laws in the way even men as well as dead material, such as wood and iron, can be manipulated. They have learned that you must study, learn and conform to natural law in order to have success. The farmer has the labourer's viewpoint through having worked hard and long for small returns. He has the capitalist's viewpoint from having thousands of dollars invested. He thus combines the two viewpoints which are so greatly responsible for much of the legislation of the pre ent day. Because of that unique social experience we need the contribution of the rural mind in the solution of national questions of government.

One final word, we must return to Canada fully aware of the fact that we are the State: only as we become personally informed and efficient in affairs of the State can we hope to have an efficient State. We should learn to discriminate between the things that should be done by the State for communities and individuals and what these communities and individuals should do for themselves. Let us avoid paternalism and its pauperising effects, and strive to learn and perform the duties of true citizenship which recognises that community rights stand higher than personal rights.

QUESTIONS ON THE STATE.

1. If your community is careless and shiftless and lacks Community Life—whose fault is it ?

2. What is the State ? On whom does the reflection of an inefficient Government fall ?

3. In what way does a farmer's experience in work and social life fit him to make a contribution to national life and government which is different from the city man's contribution ?

4. What responsibilities have the State and farmers as individuals to the people who will inhabit Canada in 2000 A.D ?

5. How does feeblemindedness affect the Community morally ? Economically ? Socially ?

6. Does the speculative holding of land militate against the farmer to-day ?

7. Why should the nation hold perpetuity of right in its water and waterways ?

8. What reasons would you give for the conservation of our forests ?

9. Has immigration been detrimental to the best interest of Canada ?

10. Has a man any right to land he does not use ?

11. Resolved, that land monopoly is the chief cause of poverty.

12. Resolved, that land values are created by the Community and should be taxed into the public treasury.

13. Resolved, that protection is justified on national grounds.

14. Resolved, that Government ownership in Canada is impracticable.

15. Resolved, that Direct Legislation will improve Representative Government.

16. Resolved, that Proportionate Representation is the next logical step in Representative Government.

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III.—RECREATION AND THE COMMUNITY.

Our slogan: "Let's get together."

We cannot introduce this subject better than by quoting from Joseph Lee, father of the playground movement in America, who says: "The thing that most needs to be understood about play, is that it is not a luxury, but a necessity; it is something that a child likes to have, it is something that he must have if he is to grow up. It is more than an essential part of his education; it is an essential part of the law of his growth, of the process by which he becomes a man at all." Play in the country is not so much to promote health, as to develop the higher social instincts. While rural depletion may be fundamentally due to economic causes, there are spiritual causes also. Play deals with some of the latter, thus preventing the enslavement of drudgery, monotony and loneliness. Isolation is thereby broken. Recreation must receive increasing attention if we hope to secure men with bodies, minds and spirits, to match our glorious heritage—Canada and its opportunities.

VALUE OF PLAY.

A brief consideration of the values of play will help us to see the significance of the above paragraph. **Physically.**—Man, in order to preserve his health, must have alternating periods of rest and work. Play furnishes him the opportunity to recreate vigour, vitality and enthusiasm after hard work. **Mentally.**—It offers the opportunity for the free play of the spirit. It is in our hours of leisure, when we can do what we choose, not in our hours of labour when we must conform to restrictions and limitations, that individuality tries itself out, discovers its powers, and realises its largest capacity. The right kind of play provides unlimited opportunity for developing sense perceptions and deep, rich character. **Morally**—it develops courage and persistence through learning to play a hard losing game to a finish. Truthfulness, accuracy, honour and many other virtues are developed under the careful supervision of the play life. **Socially.**—The greatest value of play for country life lies in its social values. Mutual suspicion, the result of the isolated life and nature of farm work, is wiped out through contact in play. Men learn to obey and subordinate their own selfish interests for the good of the team. Leaders are discovered and acknowledged. Best of all, team games develop that spirit of co-operation which we have found is so essential for happiness and progress in home, school, church, etc. Around the play life of the Community, and as a result of it, there will grow up a larger, richer, community spirit. Much more could be said in favour of play—but space forbids. Volumes have been written on the subject. It is a law of life, obedience to which prepares for the serious occupations of maturity. As a character builder it produces strength and positiveness of will.

FORMS OF RECREATION.

So that our understanding of what play and recreation are will not be limited by pre-conceptions let us review the field of play. Starting with very small children, we have games with blocks, marbles, sand-play, singing, dancing, and rhythm-games in the home which lead up to the kindergarten-school methods. One avenue of recreation sadly neglected in the home to-day is that of story-telling. In school we have manual training (where pupils choose what they shall make), modelling, and, of recent years, folk dancing, in which are preserved the deepest emotions and spiritual experience of the ages. There is next the wide range of hobbies. Of out-door recreation there is a wide choice: kite-flying, hunting, fishing, sugaring-off, hikes, excursions, picnics, etc. The field of athletics offers unbounded opportunities for individual competition and development in jumping, running, throwing, etc. The new standard method suggested in the "Tuxis Handbook" and "Outdoor Athletic Tests for Boys," by Dr. Brown, opens up wonderful opportunities for socialising athletic pursuits. The recent revival in pageants and festivals offers not only enjoyable recreation, but an opportunity to stir the community conscience to its depths. A play day, as described in Scudder's booklet, provides a basis for developing the play life and spirit in the whole community. "Camping for Boys," by H. W. Gibson, outlines very fully a most valuable form of recreation and character development for boys. Team games, organised in leagues, furnish the best chance to develop the team or co-operative spirit, besides offering an attractive form of play. In the line of clubs we have camera, nature study, bird, and collections clubs. The Boy Scouts and Campfire Girls provide an attractive programme of recreation for boys and girls. For anyone interested

in 'teen-age boys the "Tuxis Handbook" (to be secured at 120, Bay Street, Toronto) will provide an all-round, up-to-date programme of activities, physical, intellectual, social, and religious. Aquatic sport is not as widely available as it should and might be in country places. These could be secured in many places through provision of swimming holes, canoeing, and boating. In winter Canada is highly favoured with skating, snowshoeing, tobogganing, and ski-ing—we do not utilise them as we should in country life. When weather is inclement we have many indoor recreations such as Group Games (See Bancroft's book), Literary and Debating Society, Community Chorus Singing, Amateur Dramatics, Portable Moving Picture Machine, Gramophone, Orchestra, etc. Such is the range of plays and games "which are the heritage of the human race, and without sharing in which no child can grow to complete manhood or womanhood, and no adult can live a cheerful, joyous, well-rounded-out-life."—*Myron T. Scudder.*

GROUPS TO BE REACHED AND HOW TO REACH THEM.

From the above survey of the field of recreation it will be seen that there are four classes to be reached.

1. Children—the youngest of whom must be reached through the home.

2. School children must be reached by the teacher at recess time, by apportionment of time in the curriculum, by inter-school visits, at school fairs, and on Saturday afternoon.

3. Adolescents—boys and girls 13 years and over—must be reached through forming Recreation Associations and getting together one evening a week, as is being done in many school sections now.

4. Adults will be reached through Community Play Days and Saturday half-holidays.

The question is often asked—Should girls play? Girls need vigorous, healthy constitutions as much as boys and, properly dressed, they should be allowed to be as much "tomboyish" as they please. They will make all the better mothers and citizens because of the experience.

BEST TEAM GAMES FOR COUNTRY LIFE.

We would place them in the following order: **Outdoors**—(1) Football; (2) Volleyball; (3) Playground ball; (4) Captain ball; (5) Pin ball; and (6) Pin football. **Indoors**—2, 4, 5 and 6, and in addition Group Games and Carpet Bowls. The outstanding advantages in these games are (1) Large numbers are employed. (2) Small space is required. (3) Games are full of interest. (4) In these games you may develop great skill. (6) Very little equipment is necessary. (5) Mixed teams can play—male and female, old and young, hence making them community games. Rules for all of these games are in Jessie Bancroft's book.

METHODS OF PROMOTING THE PLAY LIFE.

Everywhere the need is for leaders. Play is no exception. The clergyman, teacher, lover of sport, or returned soldier, who will set himself to organising the play life of his community, will find rich rewards in discovering and developing leadership and community spirit. Many avenues are open and among them are:—

1. **The Homes**, which should have enough open, clear, lawn space and equipment for the playing of such games as croquet, tennis and volleyball. There should be a sand pile, swing, and maple board slide for the youngest children. The most important requirement of all, however, is sympathy, understanding and comradeship of parents in the play life of their young folk.

2. Every Community should have five acres at least of a **Community Playground** and the necessary equipment, so that the members of the Community may have opportunity for playing together. For the proper use of such equipment a general understanding is required among farmers to have one half-day each week when all make holiday. Is it not feasible? One good way to generate the desire for such conditions and open up the way for bringing them about is through an Annual Play Day.

3. **The School,** in the majority of cases, will undoubtedly be the play centre of the Community. It is the most natural place for it, for it is here that the play life should receive its impulse. No teacher should be allowed to teach school unless he can demonstrate his ability to play and direct others in their play. Not only do the pupils need play, but the teacher needs it. The teacher who supervises his pupils' play during recess and at other times, will be 100 per cent. more efficient in his work because of it. Every school should have equipment for the games mentioned above, besides having a sand pile, swings, giant stride, teeter, rope, etc. Most of that equipment may be secured for about $10.00 in cash, if materials can be secured from the bush and made up at home.

4. **The Church** needs to plan her social evenings more carefully. Put more into them. Use group games more at the conclusion and during evenings when solid lectures and instruction are being given. *Theological Colleges* ought to demand that their students learn to play games for their own sake and the sake of the young people of their future congregations.

5. **Women's Institutes and Farmers' Clubs** may do much by bringing in speakers to address the Community on the value and functions of play and demonstrate some games. Many such organisations have furnished playgrounds and equipment for their communities.

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QUESTIONS ON RECREATION.

1. "Play is a necessity—not a luxury." Can you justify this statement? How?
2. What is the value of play and games? Make a list of all the values that occur to you.
3. Make a list of all the different forms of play and recreation you can think of.
4. What form do you like best? Why?
5. Do you think farm boys need to go camping? What will they get out of it?
6. Were you ever a member of a team that played through a series of league games?
7. Do the boys and girls of your neighbourhood swim and skate? Are there any facilities for these recreations in your home district? Can you think of any way in which these facilities may be secured if not already present?
8. Discuss in your group what you can do to realise some of the suggestions under "Groups to be reached and how to reach them" and "Methods of promoting the play life."
9. What, in your opinion, is the best team game for country life? Why? Make a list of the games you know.
10. How may the money for play equipment be secured?
11. Where should the Community Playground be situated? Why?
12. What are the results of "nothing doing" in your community? How can such conditions be remedied?

IV.—AUXILIARY ORGANISATIONS AND THEIR WORK FOR FARMERS.

Our Slogan: "Let's get together."

The contribution of all other organisations and institutions besides the Home, School, Church, State and Business Organisation, must be auxiliary to these institutions. The auxiliary organisations must all serve to vitalise, energise, and build up these five fundamental institutions. We desire here to call your attention to the great range of them and suggest what service each is prepared to render the farmer in his family and community life.

1. Dominion Department of Agriculture, Ottawa, supports Experimental Farms throughout Canada, and will put you on their free bulletin mailing list on request. Their bulletin list will bring you all the latest results of work in (*a*) soils and their treatment, (*b*) crop varieties and treatment, (*c*) animals, breeding, feeding, etc., and many other lines of interest to farmers.

2. Provincial Departments of Agriculture, Parliament Buildings, at the Provincial Capital: (*a*) Conduct the Agricultural College: (*b*) Conduct experiments in soils, crops, animals, buildings, equipment, etc., the results of which are published in bulletins sent free to any farmer in the Provinces. Send in your name and address to the Publications Branch. (*c*) Most of them have Agricultural Representatives, who are located in the county town, and are available for consultation, conduct demonstrations, organise farmers' co-operative enterprises, conduct four-week short courses in agriculture, besides many other agricultural activities. (*d*) Organise and give grants for Agricultural Societies which conduct Fall

Fairs and standing Field Crop Competitions. (*e*) Organise and give grants for Horticultural Societies to promote home and community beautification. (*f*) Organise Boys' and Girls' Clubs in poultry, pig-keeping, canning, cooking, gardening, etc. (*g*) Have Live Stock Branches for promoting Live Stock interests. (*h*) Have a Market and Co-operation Branch, which promotes co-operative handling of eggs, wool, live stock, etc. (*i*) In the Institutes Branch, have a corps of speakers, lecturers, and organisers who are available for the asking. If there is anything pertaining to country life that you want assistance in—write to your Provincial Department of Agriculture.

3. The Agricultural Colleges (*a*) conduct a two-year course for men who return to the farm and a four-year course for farmers, home-makers, managers, supervisors, teachers, research leaders, etc. Secure a calendar. (*b*) Conduct from two to three weeks' short courses in all agricultural subjects during the winter term; (*c*) have a series of Extension Lectures on all agricultural subjects—some of them conduct package libraries for supplying debate material (both of these services are rendered free or at cost of travelling and entertainment expenses): (*d*) conduct research work along technical, economic, and sociological lines; (*e*) conduct an enormous correspondence service. They are your servants—use them—write to the President of the College for information.

4. The Department of Education will supply speakers and literature on rural education. Address: The Provincial Capital.

5. The Department of Public Health publishes many bulletins available free on request. They supply speakers and in some cases are considering the support of a District Nurse system throughout the Province.

6. The Provincial Librarian in many cases controls a system of travelling Libraries. You need not lack good literature.

7. The Farmers' Institutes conduct two-day institutes with five sessions consisting of practical talks and demonstrations. Speakers are supplied for the Institutes by the Government.

8. Women's Institutes and Home Economics Societies have as their motto "For Home and Country." They conduct one and two day meetings, discussing domestic science and arts and various social problems. Speakers will be supplied for such meetings, on request, by Provincial Department of Agriculture.

9. Provincial and National Farmers' Organisations, such as United Farmers of Alberta, United Farmers of Ontario, Manitoba Graingrowers' Association, Canadian Council of Agriculture, etc., are largely economic organisations but also promote social, educational and other propaganda. Every farmer should know of their work.

10. All the churches have various boards which look after such work as Social Service, Sunday School Work, Young People's Associations. These Boards are prepared to furnish speakers, literature, etc., concerning rural problems. Address your denominational headquarters.

11. Provincial Sunday-School Association publishes literature, furnishes speakers and conducts conventions on Sunday School work.

12. The National Council of the Young Men's Christian Association, 120, Bay Street, Toronto, has a special Rural Work Department. Write for their literature.

13. The Dominion Council Young Women's Christian Association, Bloor Street W., Toronto, will be glad to help in special Girls' Work.

14. The Press. Every home should subscribe for at least one of the following classes of papers: (1) Daily. (2) Weekly. (3) Agricultural weekly. (4) Literary and story. (5) Religious papers. (6) Women's magazines. (7) General magazines. Every home ought also to have a moderate-sized easily accessible library of books. With such equipment the home will be kept in touch with up-to-date methods and events in all phases of community life.

15. The Canadian Problems Study Clubs—Secretary, Prof. McIver, Toronto University. They are prepared to furnish outlines for the study of national questions along economic, social and other lines.

16. The Children's Aid Society, Parliament Buildings, Provincial Capital, through the Children's Protection Act, furnishes the most effective method of dealing with homes where delinquent or neglected children live.

These agencies are organised to help you. One thing only is necessary to secure their assistance—drop them a postcard and "Let's get together."

QUESTIONS ON AUXILIARY ORGANISATIONS.

1. Make a list of all the organisations outside the community that you know of, who are prepared to help the farmer, and state what help may be secured from each.

2. What are Government Bulletins? How can you secure them?

3. Where is your Provincial Agricultural College? What service does it render to farmers?

4. Do you know whether there is an Agricultural Representative of the Department of Agriculture in your district? If so, what service can he give you?

5. Have you ever taken a short course in Agriculture? Why not take one now at the Khaki College in your camp or through correspondence from 38, Bedford Square, London, W.C. 1.

V.—A COMMUNITY FEDERATION AND ITS RELATION TO THE COMMUNITY.

Our Slogan: "Let's get together."

The purpose of the Community Federation is to draw together all the social organisations in the Community which make for progress. By annual conference, frequent joint executive committee meetings, and other means, the interests of the Community as a whole will be kept continually in mind, duplications of effort avoided, concentration of attention and energy secured when and where needed.

WHAT IS IT?

Can it be done? Is it only a dream? If we can't draw together in a small Community thus—how can we hope for a League of Nations? We do not dogmatically state that it can be done, but just wish here to point out some examples that indicate that the trend is towards federation of all social forces. The idea may be seen working within individual organisations, e.g., the little red school houses are becoming large Consolidated Schools; Farmers' Clubs are forming Provincial Organisations

and even National Federations, e.g., the Canadian Council of Agriculture; Churches are federating and uniting. The instinct to work together is one of the strongest in human nature, if the right conditions are furnished. It is evident in organisations of all kinds. In the following brief review of some of the most outstanding examples all the institutions of society are represented—Home, School, Church, Social Life, Business, and Community.

1. **Home.**—In this field the outstanding rural example is the marvellous growth of such organisations as the Women's Institutes, Home Economics Societies, and United Farm Women, which are federations of homes for "Home and Country" progress.

2. **School.**—(*a*) The Hesperia Movement originated in Hesperia, Michigan, in 1885-86. It started as a result of the desire to draw together the teachers and parents of Hesperia Community. In 1893 it was enlarged to include two counties, and to draw together Home, School, and Grange. The object is to unite parents, teachers, pupils, and Grangers for better rural school education. Every year a large conference is held lasting two and a-half days and drawing thousands to its meetings. (*b*) Consolidation of Rural Schools has spread until now there are over 11,000 in the United States, and more are still being rapidly organised.

3. **Church.**—(*a*) In Pennsylvania the basis adopted has been a County Federation of Churches which, according to Dr. Warren Wilson, has proved effective in public reform, sanitation, etc. (*b*) The New England Federation of Churches is doing valuable service in bringing the churches of Massachusetts and Rhode Island to a sense of their community responsibilities. (*c*) The Federal Council of Churches of Christ in America

includes over 60 (practically all) of the Evangelical Churches in America. It acts as a clearing house and helps to secure many things which individually the churches could not secure.

4. **Social Life.**—The Grange unites farmers by tens of thousands throughout the United States. It builds community halls, educates, provides social life and training through weekly meetings, and seeks to organise co-operative buying among farmers.

5. **Business.**—The Canadian Council of Agriculture is a federation of Provincial Farmers' Organisations, and seeks to promote the interests of Canadian farmers in a national way.

6. **Community.**—Here we come in contact with the first attempts at federating *all* the social forces of farm life. (*a*) The McHenry County Federation, Illinois, formed in 1904 by Rev. G. T. Nesmith, of Hebron. The object is "to have life, and have it more abundantly," in the "largest aggregate and highest symmetry of the sixfold ends of individual and community action, viz., health, wealth, knowledge, sociability, beauty, and righteousness." It proposes to be "a clearing house and a fraternal bond which shall link all together in common ties of sympathy, fellowship, and co-operation." It holds annual conferences to stimulate community life, includes all organisations interested in rural life, and has met with considerable success. (*b*) The Rhode Island League for Rural Progress—1906—includes 13 rural organisations, and invites any other to join. Its object is "to secure the co-operation of the various individuals, organisations and agencies which are working in any way for rural advancement in this state." (*c*) Denmark is the most remarkable and comprehensive national or country-wide example in the world, covering,

as it does, in the one movement, farm production, manufacturing of country products, protection of health, saving, credits, insurance, banking, tuberculosis sanatorias, legal advice, etc. (*d*) Read the "Life of Oberlin," and see how one man federated all the organisations and rejuvenated the whole community life in a mountain district. (*e*) The Social Service Council of Manitoba, Winnipeg, are developing Community Clubs, to include all the organisations of a community, "to think together, work together, and play together," through lectures, demonstrations, debates, and community action on such subjects as sanitation, public health, play, etc.

HOW?

The Federation is an Ideal gradually to be realised—the striving for which will bring great good to a community. It is the supreme demonstration of the spirit of our slogan "Let's get together." The rural community, as we have seen, needs home, school, church, etc., but it also needs a working together of these organisations "Only the intelligent, efficient, and harmonious co-operation of all these forces will insure the best progress."—*Butterfield*. How shall we secure it? (1) Hold an annual Community Life Institute as outlined in the "Suggested Year's Programme," in the pamphlet, "Building the Rural Community." Secure the help of your Agricultural College in carrying out the Institute. (2) Carry out an annual programme of Community Gatherings as outlined in "Building the Rural Community." (3) Unite the leaders in a Study Club or League for Rural Progress. (4) Encourage all efforts along this line now under way and "set at work all the agencies (Home, School, Church, etc.), that will tend to bring this ideal about—each in his own field for the one goal of a new and permanent rural civilisation."—*Country Life Commission.*

AN EXAMPLE.

The Rural Community Life Movement of Ontario was organised in 1917 at the third Annual Summer School for Rural Leadership at the Ontario College, Guelph. It was organised for the purpose of accomplishing this very federation. Its object is "to promote the highest ideals of rural community life, economic, social, educational, religious, and recreational." It comprises now representatives from the Anglican, Baptist, Methodist, Presbyterian, and Roman Catholic Churches, The Women's Institute, the United Farmers' of Ontario, the Young Men's Christian Association, Young Women's Christian Association, Departments of Agriculture and Education, the Social Service Council of Ontario, and the Social Service Department Toronto University. Its constitution provides for the inclusion of any other organisation engaged in rural progress work. Its first year's task was the promotion of four Community Life Institutes held in country villages from Friday evening to Sunday evening with eight sessions covering a programme as follows: (1) "The Problems of this Community—Home, School, Church, etc.," by five local residents. "Community Building—a Presentation of the Principles of Community Work." (2) The School—"Education for Country-Life," "Consolidation," "Medical Inspection of School Children." (3) Recreation—Address on Recreation and Demonstration of Games—playground ball, volley-ball, etc. (4) Farm Business—"Co-operation," "Farm Management Survey." (5) "The Home-Partnership," "Conveniences." (6) "The Church and Country-Life." (7) "Adult Bible Class Work," "Study Clubs," "Boys' and Girl's Work." (8) Union closing session "Pulling together for Community Progress." Its second task was the promotion of the Annual Summer School for

Rural Leadership at which 80 men and women attended. Its future plans include: (1) Promotion of Summer School as the annual rally of leaders. Money has been secured to be used in scholarships for those who perform Community services. (2) Institutes will be held in 10 or 12 zones throughout Ontario. (3) Social Centres will be established wherever a representative committee of ten will install motion picture projecting apparatus and will build around the moving pictures programmes of local talent. (4) Promotion of Study Clubs—These clubs will be furnished with outline study courses. (5) Visitation, consultation, correspondence and clearing house, operated by its Secretary at the Ontario Agricultural College.

IN CONCLUSION.

		C				
Home improvement		O		C		
Educational progress		-		O		P
Religious advance		O		M		U
Business returns		P		M		R
State development	all	E	or	U	of	P
Rural health and recreation	spell	R		N		O
Proper use of Auxiliary		A		I		S
Organisations		T		T		E
Community Life and Federation		I		Y		
		O				
		N				

"Let's get together."

QUESTIONS ON COMMUNITY FEDERATION.

1 What instances can you quote which illustrate the working out of the co-operative idea in Home, School, Church, State, Business and Community affairs?

2. Do you think all the social institutions of your community could be drawn together and harnessed for community purposes ? How ? What community tasks can be done unitedly only ?

3. Plan a programme for a Community Life Institute, running from Friday night to Sunday night, with seven sessions, covering (1) Community ; (2) Home ; (3) Recreation ; (4) Business ; (5) School ; (6) Church ; (7) Auxiliary Organisations. Suggest two or three topics for each session which would meet the needs of your own home Community.

4. What difficulties lie in the way of federating all the local social forces ?

5. If you are interested, and desire to follow this matter still further when you return home—sign the registration slip in this pamphlet and return to the address given.

If you are interested in this matter and would like to be put in touch with those who are promoting its interests in Canada, please fill out the attached form and mail to:—

A. MACLAREN,

Department of Agriculture,

Khaki University of Canada,

31, Bedford Square,

London, W.C. 1.,

who will send you the names and addresses of those in your Province who can help you further.

Name ....

Canadian Address (where you intend settling)

....

....

Please state what part you have taken in Community

Life ....

....

Would you like to enlist in Community Service ?

....

What particular phase are you interested in ?

....

....

Any criticism of the material in this pamphlet—especially constructive ideas—will be welcomed at the before-mentioned address.

Tear off at perforation and mail AT ONCE.

J. C. KING, LTD.,
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FARM ACCOUNTS

KHAKI UNIVERSITY OF CANADA

Series 1.—No. 15

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FARM ACCOUNTS

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Four Generations of Farmers

The purpose of this Booklet is to make possible the keeping of reliable Farm Accounts on every Farm in Canada

PUBLISHED BY THE
KHAKI UNIVERSITY OF CANADA

FARM ACCOUNTS

PART I.

INTRODUCTION.

There is a steady growing demand among farmers for a simple practical system of keeping farm accounts. Among the men overseas who plan to return to their former occupation of farming in Canada there has been an urgent request for an outline of such a system. The Khaki University of Canada obtained and has made use of every Canadian system recommended and has made a careful study of several English and United States text-books on the subject. We trust that this little booklet will find its way into every school in Canada. After you are through using your copy, kindly hand it to the school teacher in your district for the use of the children who are going to keep the farm accounts of Canada in the near future.

We will attempt to give the farmer a simple system of keeping accounts, requiring no special training other than a knowledge of arithmetic and an expenditure of time not exceeding ten or fifteen minutes per day on the average mixed farm.

Before going into the details of an account system, it is well for the farmer to realise the importance of accounts in his business. Well kept accounts will increase his profits. They will add greatly to his business standing in the community. They may be used to overcome new difficulties that have arisen in the business of farming.

The farmer is a business man as well as a practical and scientific man. He is more than this, he is usually a capitalist. His business and his business ability are vital to his community. It is the prosperity of the individual farmer that brings outside capital into the district in the form of railroads, telephones, elevators, creameries, etc. His business is of the greatest importance to the State, for only through the wealth and ability of the individuals do nations become powerful. Even in England, a "manufacturing" country, the wealth from agriculture exceeds that from any other industry.

The average farmer does not realise how close the business world is in touch with his individual business. His name, wealth, and business standing have been printed in a book that is in the hands of every banker and big merchant in the country. In many cases this financial record is more accurate about his affairs than his own estimate would be. These records all go to show whether his business is going ahead or falling behind. Would such information, kept in more detail by the farmer himself, not be of even greater interest to him than it is to other people ?

By keeping accurate account of his dealings with other people, he is able to tell at any time how much he owes and how much others owe him, thus avoiding many unpleasant arguments and miscalculations. He will be able to check accounts received from his local merchants and have mistakes corrected. Quite often he can collect a disputed account merely by showing that he does keep accounts, for properly kept books are recognised in any law court. A good set of accounts keeps a man out of the law courts by not leaving anything in doubt.

A system of accounts will enable the farmer to make

out a statement of his net worth, go to his banker and borrow money on short loan at a low rate of interest. Bankers want to know that their money is in safe hands, but as a rule they are only too anxious to loan money to farmers who can show that they know what they are doing with it. Incidentally, the information gets abroad in the business world that the farmer is carrying on his business along business lines. Then his business rating goes up, and he finds it much easier to obtain credit everywhere.

At the end of the year the farmer who keeps accounts is able to figure out his net profit or loss during the year. He is also able to determine how much interest he has made from his investment in the business, and how much his labour-income has been for the year.

From the information that he gets from his simple account system he is able, during the slack season, to figure out the profit or loss made in each department of his business. It is not likely that a farmer will continue to raise from year to year some crop that persists in showing a loss and therefore eating into the profits made by some other form of produce. To reap the full benefit from his labours he must know where he is making money and where he is losing money.

He may go further with his figures and find out what it costs him to produce a bushel of grain or a pound of meat or butter-fat, and to know at the same time what has made them cost what they do. With this knowledge before him he is able to start in systematically to reduce the cost of those products so that they will leave him a greater margin of profit.

The farmer to-day finds himself confronted by many economic difficulties in the way of the continual rise in wages for farm labour, the increased cost of machinery,

horses, feed, etc. Quite often the selling price of his product does not keep pace with these rising costs. What is he to do about it ? For many years the manufacturer has had to meet these same difficulties ; paying higher wages without being able to increase the selling price. How has he done it ? By keeping cost records ; by utilising spare time ; by stopping the leaks in his business ; by getting the greatest possible return from the money expended. Manufacturers who keep adequate cost records are able to show a profit where other men go into bankruptcy. They see where it is profitable to them to pay higher wages for skilled help or for reliable unskilled help and they do so. This has its effect upon the farmer by his having to compete with the manufacturer in the labour market.

Just as the manufacturing world has seen the "survival of the fittest" so will the agricultural world. The farmer is in competition with modern business methods and if he is to come out on top he must arm himself with all the knowledge that cost records are able to give him.

It is hoped that the following pages will give the average farmer the key to obtaining this knowledge. We have tried to make it so plain that previous knowledge of book-keeping is not essential. None of our records or calculations go beyond simple arithmetic, and all records have been devised with the object of economy of time as well as for efficiency. Only at the end of the year, during the slack season, need any great amount of time be spent upon the cost records described in these pages.

The most convenient time to start keeping accounts and to take an inventory is during the slack time of late winter or early spring, when most of the stocks

are low, and most of the live stock has been finished off and sold.

We suggest, for the average Canadian mixed farm, about the 1st of February or 1st of March ; but much depends on the kind of farming followed. On a poultry farm, perhaps the 1st of October or November would be the best time.

When the land is leased, it would be convenient to begin the financial year the same date as the lease commenced.

To succeed in keeping accounts, the farmer must make it one of his regular daily chores. To allow accounts to accumulate without posting regularly to the ledger, means that they will never be posted, as they will soon amount up and become an irksome task. Perhaps the best way is to do them right after one of the regular chores ; say, following the evening milking. The five or ten minutes will not be noticed then, it will not interfere with the evening's rest, and one is not so apt to forget.

THE INVENTORY.

The first step for the farmer to take when commencing a system of accounts is to make out a complete inventory, or simple statement, of everything on the farm ; giving every item a value, based on what it is worth.

For this purpose, select a book about 12 by 9 inches with feint ruled lines across the page and a money column at the right hand side, if such a book can be found. An ordinary school copybook or composition book will answer the purpose very well, and the money column can be ruled in with a pencil.

In order to find out the total investment in each department of the business, set apart sufficient pages

for each department, and write down everything that belongs to one department under its proper heading. It is not necessary to write in the values as you put the items down, as this can be done later after you get everything listed.

On a mixed farm, you will have such departments as :

Land.
Buildings.
Machinery and tools.
Horses.
Dairy.
Swine.
Sheep.
Poultry.
Garden and orchard.
General produce (field crops).

Under the heading of " Land," put down the total number of acres belonging to the farm, the number of acres under cultivation, etc., and in the money column put a fair value on the land, based upon the cost of unimproved or unbroken land in the neighbourhood, plus a fair amount for the cost of clearing and breaking. Also under this heading list all permanent improvements to the land, such as tile drains and fences ; but when figuring the value of fences remember that fences depreciate every year. If a fence is expected to last twenty years, deduct one-twentieth of its cost for each year that it has been standing to arrive at its present value.

Under the heading of " Buildings," enter all the buildings on the farm ; the house, the barn, hog house, poultry house, granaries, sheds, etc. Give each building a value based upon cost, less a fair amount for depreciation, according to how long it may be expected to

last. With the best of care, buildings depreciate from 2 to 4 per cent. a year, while others may run more than this. It is well to write in the inventory the amount you are deducting each year for depreciation, as you will want to refer to it later.

Under "Machinery and Tools," list all machines, implements and tools that are used by more than one department, such as wagons, sleighs, racks, tillage implements, haying implements, binder, engine, feed-chopper, small tools, etc. Figure their value by what they cost, less a fair amount for depreciation. Small tools may be figured to depreciate at 10 per cent. a year, but implements will last anywhere from five to twenty-five years, according to the nature of their use and the care that is taken of them. (See Appendix.)

All breeding stock should be valued according to its worth for breeding purposes.

Under "Horses," enter all horses and colts at a fair market value; also the harness, on which depreciation should be figured at from 6 to 10 per cent.

Under "Dairy," enter all dairy cows according to their value as producers, and calves at the prices they could be expected to bring if sold. Also the cream separator, milking machine, pails, etc.—anything that is used by the dairy department and no other department. Do not neglect to figure depreciation on machines. If you have any dairy produce on hand, not yet sold, such as butter, cream, milk, etc., include this in the inventory at market value.

Under "Swine," enter all hogs and pigs at a fair market value. Also list any special equipment for swine, such as troughs, self-feeders, etc.

Under "Sheep," enter all sheep and lambs according to their value, as well as any wool not yet marketed.

Under "Garden and Orchard," enter all berry bushes, young trees, and bearing trees, according to their value; also any produce from this department still on hand.

Under "General Produce," enter all stocks of grain, feed and forage on hand, including contents of silo, straw stacks, haystacks, etc., at their market value. The Appendix gives simple rules for measuring the contents of stacks, bins, etc.

Household effects will not be included in the business inventory, as they cannot be considered as part of the farm equipment.

It is a good policy, however, to make out an inventory of household effects, and file it in a safe, so that in case of fire you will have no trouble in collecting your insurance.

The following are specimens, showing how to make out an inventory on Land, Buildings, Horses and General Produce.

Inventory of Land.

160 acres of land, value in natural state \$12.00 per acre ..	\$1,920.00	
100 acres under cultivation, cost to clear and break	1,900.00	
Value of the land ..		\$3,820.00
1,200 rods, 3 strand wire fence, 5 years old, cost of material labour	\$495.00	
Depreciation at the rate of 5 per cent. a year for 5 years	123.75	
Present value of fence ..	..	371.25
Total of Land Inventory	..	\$4,191.25

6-room house, 5 years old, original cost	$2,000.00	
Depreciation, 2 per cent. for 5 years	200.00	
Present value of house ..		$1,800.00
Barn, 32 by 42, 7 years old, original cost	1,850.00	
Depreciation, 2 per cent. for 7 years	259.00	
Present value of barn ..		1,591.00
Hog house, 4 years old, original cost	250.00	
Depreciation, 4 per cent. for 4 years	40.00	
Present value of hog house ..		210.00
Granary, 16 by 24, 7 years old, original cost	300.00	
Depreciation, 4 per cent. for 7 years	84.00	
Present value of granary ..		216.00
Machine shed and tool house, 4 years old, original cost ..	325.00	
Depreciation, 4 per cent. for 4 years	52.00	
Present value		273.00
Carried forward		4,090.00

Brought forward		$4,090.00
Poultry house, 6 years old, original cost..	200.00	
Depreciation, 4 per cent. for 6 years	48.00	
Present value		152.00
Total inventory value of Buildings ..		$4,242.00

Inventory of Horses.

Grey mare, Flora, 10 years old		$150.00
Roan mare, Nellie, 8 years old		175.00
Bay horse, Jim, 7 years old		150.00
Bay mare, Bessie, 7 years old		175.00
Black horse, Star, 6 years old		150.00
Black mare, Gip, 5 years old		165.00
Two year old colt, Tony		78.00
2 yearling colts, @ 50.00		100.00
1 set work harness, 10 years old, cost..	$40.00	
Depreciation, 6 per cent., 10 years	24.00	
		16.00
1 set work harness, 3 years old, cost	45.00	
Depreciation, 6 per cent. 3 years	8.10	
		36.90
1 set driving harness, 2 years old, cost..	25.00	
Depreciation, 10 per cent. 2 years	5.00	
		20.00
Total Inventory, value of Horses ..		$1,215.90

Inventory of General Produce.

600	bushels	oats,	@ .60	.. .. ..	$360.00
100	,,	wheat	,, 1.50	.. .. ..	150.00
225	,,	barley	,, .75	.. .. ..	168.75
15	tons	timothy and clover hay @ 16.00		..	240.00
4	,,	wild hay @ 6.50		.. .. ..	26.00
$1\frac{1}{2}$	,,	mangels ,, 10.00		.. .. ..	15.00
150	bushels	potatoes @ 1.00 per bushel		..	150.00
Total Inventory, value of General Produce				..	$1,109.75

In the back of the Inventory Book set apart two pages for accounts receivable (money to be collected) and accounts payable (debts). Under Accounts Receivable make a list of the names of all persons who owe you money, and the amount they owe.

Under Accounts Payable make a list of the names of all persons to whom you owe money, including mortgages on the farm, notes for live stock and machinery bought, unpaid taxes, unpaid interest charges, borrowed money, etc., with the amount you owe after each name.

You are now able to arrive at a statement of Assets and Liabilities, and your "Net Worth" at the beginning of the financial year. To do this, add together the total inventory for all departments, your total cash on hand and in bank, and the total of Accounts Receivable. These are your Assets.

From your total Assets substract the total of Accounts Payable (which are your Liabilities), and you will find your Net Worth.

STATEMENT OF NET WORTH

on February 1st, 1917.

ASSETS.

Cash on hand and in Bank, total		$216.35
Accounts Receivable (accounts owing to you)..		120.00
Inventory of Land	$4,191.25	
,, Buildings	4,242.00	
,, Machinery and Tools	1,200.00	
,, Horses	1,215.90	
,, Dairy	985.00	
,, Swine	1,000.00	
,, Sheep	300.00	
,, Poultry	50.00	
,, Garden and Orchard	400.00	
,, General Produce ..	1,109.75	
Total Inventory		14,693.90
Total Assets		$15,030.25
Accounts Payable (accounts you owe) ..		3,525.50
Net Worth on this date ..		$11,504.75

THE LEDGER.

The ledger is a book in which each account is kept separate from all other accounts, so that the financial condition of any particular account may be ascertained at any time.

A convenient size for farm accounts would be a book about 12 by 9 inches, containing from 100 to 200 pages. This can be bought at any stationery store at a cost of about one dollar.

The following is a sample of a common form of ledger ruling and headings.

Name of Account....................

Date.	Items.	Debits.	Date.	Items.	Credits.

Debit and Credit.

The principle of keeping a ledger account is to "charge" the account with the value of everything you put into it, by writing the amount in the left-hand column marked "Debits," and to credit the account with the value of everything you take out of it, by entering the amount in the right-hand column marked "Credits."

For instance, Mr. Brown owes you money for some produce that he has bought. You open an account in the ledger under the name of Mr. Brown, and write the amount he owes you in the "debit" column. This represents the amount of your wealth that you have put into the hands of Mr. Brown. Any more purchases that he makes are also written in this column, so you always have a record of what Mr. Brown owes you.

Whenever Mr. Brown pays you some of the money that he owes you, it is the same as taking some of your wealth out of the hands of Mr. Brown, so you write the amount on the "Credit" side of his account.

You can subtract the total credits from the total debits at any time, and find out how much he still owes you.

If, on the other hand, you owe money to someone else, say Mr. Smith, you open an account in the ledger under the name of Mr. Smith, and write the amount you owe him in the "Credit" column, for you have taken from Mr. Smith something that you have not yet paid for.

When you pay Mr. Smith money on account, you write the amount on the "Debit" side of Mr. Smith's account, and when the total debits equal the total credits, you know that this account is settled.

Accounts with the different departments of your business are kept in exactly the same way. If you put some of your wealth into horses, you open an account in the ledger under the name of "Horses," and write in the "Debit" column the amount of your investment in horses. Anything you receive from the sale of horses is written on the "Credit" side of "Horse" account; so, no matter how many horse transactions you have, you can always total up the amounts that you have put into this branch of the business and the amounts that you have taken out of it, and reckon the profit or loss that you have made.

The "Cash Account" is kept in the same way; but to thoroughly understand the principle of keeping a cash account you must imagine that all of your cash on hand is put into a cash drawer. You open an account in the ledger under the heading of "Cash Accounts," and write the amount of cash on hand and all cash that you receive, in the debit column. When you take money out of the cash drawer or wherever you keep your cash, for the purpose of making a purchase or paying a bill, you write the amount in the credit column of cash account.

You can find out the amount of cash you have on

hand at any time by subtracting the total of the credit column from the total of the debit column.

Now you will see that each account in the ledger deals with one particular person or one branch of the business.

But each account in the ledger will bear a certain relation to some of the other accounts; for, suppose you take money out of cash account to buy a horse, you will have two entries to make in the ledger. You will "credit" Cash Account for the money taken out, and "debit" Horse Account for the value put into horses.

Likewise, if you sell a horse for cash, you will "credit" Horse Account for the amount of the sale, and you will "debit" Cash Account for the money put into the cash drawer.

Suppose the horse had been sold to Mr. Brown to be paid for later, it would simply amount to taking some of your wealth out of horses and putting it into the hands of Mr. Brown; so you would "credit" Horse Account and "debit" Mr. Brown's Account.

Every business transaction, whether you buy or sell, will call for two entries in the ledger. One on the debit side of one account for what you have put into it, and the other on the credit side of some other account for what you have taken out of it.

In other words, every "debit" must have a corresponding "credit," and every "credit" must have a corresponding "debit." That is why it is referred to as "*Double Entry Book-keeping.*"

When you understand this one principle of book-keeping, you are ready to start keeping accounts in your ledger.

Read this description of the ledger over again and again.

STARTING THE LEDGER.

The most used account in the ledger will be Cash Account, so it will be convenient to have this on the first page of the book. Therefore, on the first page of the ledger write in the heading "Cash," and enter in the left-hand column on the first line the date, under "Item" the words "Cash on hand," and in the column headed "Debits," the amount of money on hand and in the bank, as shown by your statement of net worth at the beginning of the year. (See page 19.)

Referring to the rule that every entry on one side of the ledger calls for a corresponding entry on the other side of the ledger, you will ask what account this amount is to be credited up to. Where did the money come from? Did it not come out of your own wealth? The farm itself, and everything on it is part of your wealth. This cash on hand is part of your wealth, but it has been taken out of your personal funds and put into Cash Account for the purpose of running the business. Therefore you will head the next account "Personal Account," and enter on the first line on the credit side the date, "Cash on hand," and the amount.

It is best to allow plenty of pages for each account. Cash Account will be the largest account in the ledger, so probably fifteen to twenty pages should be allowed for this account for the year's business. Two or three pages will be sufficient for "Personal Account," as this is not used so much.

After "Personal Account" will come the department as listed in your inventory. "Land" will probably require one page, "Buildings" one page, "Machinery and Tools" two to four pages, "Horses" two to four pages, "Dairy" four to six pages, "Swine" two to

Name :—

CASH.

Date	Item	Debits $	Debits c.	Date	Item	Credits $	Credits c.
Feb. 1	Cash on hand ..	216	35	Feb. 1	Cheque to Martin for mare ..	200	00
,, 3	Sold eggs ..	1	50	,, 2	Groceries ..	3	75
,, 4	Cream cheque ..	60	00	,, 4	Plough	25	00
,, 6	John Brown ..	16	00	,, 6	Shoeing horses..	4	00
,, 8	Borrowed from Bank	100	00	,, 10	Paid Bates & Co.	60	00
				,, 10	Paid Geo. Smith	40	00

Note.—See statement of Net Worth on page 14.

four pages, "Sheep" two to four pages, "Poultry" four to six pages, "Garden and Orchard" two to six pages, "General Produce" two to four pages, and other departments in proportion. These are mere suggestions ; the main thing is to allow sufficient pages for each.

On the first line on the debit side of each of these departmental accounts, enter the amount as shown by the inventory (see specimen ledger pages), and enter a corresponding amount on the credit side of Personal Account.

Next will come your Expense Account for keeping track of all expenditures for the operation and general upkeep of the business, such as labour, repairs, insurance, taxes, interest, veterinary, horseshoeing, etc.

At the end of the year you will want to know the total amount paid out for certain of these items separately, as follows : "Household Expenses," "Machine Repairs and Expenses," "Horse Expenses," "General Farm Labour," "Land Expense" and "General Expense."

You will have no entries to make in these accounts at the beginning of the year, but later expenses will occur, and they will be entered on the debit side of one of the Expense Accounts, observing the following rules :—

Under "Household Expense" enter everything bought for the house, such as groceries, meat and other table supplies, fuel, light, etc.

Under "Machine Repairs and Expenses" enter repairs to all machinery, wagons, engines and tools, lubricating oil, fuel for engine, etc.

Under "Horse Expense" enter cost of shoeing, veterinary fees for horses, medicines, special feed bought, etc.

Under "General Farm Labour" enter all amounts paid for labour used in the ordinary operations of the farm.

Under "Land Expense" enter all amounts paid for repairing fences, fertilizers for the land, removing pests, etc. Anything that you spend upon the land itself, that is not a permanent improvement.

Under "General Expense" enter all amounts spent for the general upkeep of the farm. Items that benefit all the departments or several departments, and that cannot be charged directly against any one department, such as insurance on buildings, interest on mortgages, taxes, repairs to buildings, etc.

Anything that is expended solely for any of the other departments should be charged direct, such as service fees, veterinary fees, etc., for cows would be charged against "Dairy." Special feeds bought for fattening hogs would be charged direct to "Swine," as these items would go to increase the cost only in their own departments, and do not affect any other department.

The object of keeping a separate account of machine expense, horse expense and land expense will be explained later.

After Expense Accounts will come your accounts with other people. Referring to the list of Accounts Receivable in the back of the inventory book, open an account in the ledger with each person or firm who owes you money, writing in the amount in the debit column of their account.

When this is done make an entry on the credit side of "Personal Account" for the total amount of Accounts Receivable.

Now refer to the list of Accounts Payable, and start an account in the ledger with each person or firm to whom you owe any money, on mortgages, notes, or for purchases. Enter the amount you owe them on the credit side of their account.

Make an entry on the debit side of "Personal" Account for the total amount of Accounts Payable.

TRIAL BALANCE.

You have now "opened your books," and if you will add up all of the amounts on the left hand side, or "debit," and then add up all the amounts on the right hand side, or "credits," you will find that the total of one side of the ledger exactly corresponds with the total of the other side.

If the two totals do not correspond with one another it means that you have made a mistake in writing down some of the amounts or in addition, and you will have to find the mistake and correct it.

Adding up the two sides of the ledger in this way is called taking a "trial balance," and as your work progresses and the entries in the ledger increase, it is a good plan to do this once every few weeks to detect any mistakes you may have made and correct them before they go too long.

THE BLOTTER OR DAY BOOK.

As you carry on your business from day to day, the thing to do is to write down each transaction under the proper accounts as soon as possible, but it is not convenient to run to the house for the ledger every time you sell or buy anything, neither is it a safe plan to trust to memory to write them down when you get home at night, so for safety in keeping track of expenditures and sales, as well as for convenience in "posting your ledger," a small memorandum book or "blotter" is recommended.

The blotter should be of convenient size to carry in the pocket. The entries made in it are the record of each transaction that you make during the day, and

should contain the following information: Nature of transaction, which account to debit, which account to credit, and the amount of the transaction.

The following are some specimen entries in the blotter:—

Feb. 1	*Dr.* John Brown.	*Cr.* Genl. Produce	
	1 ton timothy hay sold		$16.00
Feb. 1	*Dr.* Horses	*Cr.* Cash	
	Bought 6-year old roan mare (from James Martin) for cash		200.00
Feb. 2	*Dr.* Household Exp.	*Cr.* Cash	
	Groceries		3.75
Feb. 3	*Dr.* Cash	*Cr.* Poultry	
	Sold 3 doz. eggs at $0.50		1.50
Feb. 4	*Dr.* Cash	*Cr.* Dairy	
	Cream check for 200 lbs. fat at $0.30		60.00
Feb. 4	*Dr.* Tools	*Cr.* Cash	
	Bought new 16-in. breaking plough		25.00
Feb. 6	*Dr.* Cash	*Cr.* John Brown	
	Received payment for hay		16.00
Feb. 6	*Dr.* Horse Expense	*Cr.* Cash	
	Shoeing Bessie and Flora		4.00
Feb. 6	*Dr.* General Exp.	*Cr.* Bates & Co.	
	Insurance on Buildings		60.00

Feb. 8 *Dr.* Swine *Cr.* Geo. Smith
Bought 1 ton middlings for hog feed $40.00

Feb. 8 *Dr.* Cash *Cr.* Merchants' Bank
Borrowed on 30-day note, 6 per cent. 100.00

Feb. 10 *Dr.* Bates & Co. *Cr.* Cash
Paid insurance 60.00

Feb. 10 *Dr.* Geo. Smith *Cr.* Cash
Paid for feed 40.00

Each evening the various transactions can be entered under their proper accounts in the ledger by reference to the "blotter" or day book. As the different items are transferred to the ledger they should be checked off the blotter by a simple check mark (v) or by writing the number of the ledger page to which they have been transferred alongside the name of the account as it appears in the blotter. In this way you make sure that you have transferred each entry to its proper account. and have not overlooked any.

The entries shown in the specimen blotter will appear in the ledger as follows :—(Cash Account, page 19.)

Name :— JOHN BROWN.

Date	Item	Debits		Date	Item	Credits	
		$	c.			$	c.
Feb. 1	1 ton timothy hay	16	00	Feb. 6	Paid account	16	00

Name :— GENERAL PRODUCE.

Date	Item	Debits		Date	Item	Credits	
		$	c.			$	c.
Feb. 1	Inventory	1,109	75	Feb. 1	1 ton timothy to Brown ..	16	00

Name :— **HORSES.**

Date	Item	Debits $	Debits c.	Date	Item	Credits $	Credits c.
Feb. 1	Inventory ..	1,215	90				
,, 1	Roan mare from Martin.. ..	200	00				

Name :— **HOUSEHOLD EXPENSE.**

Date	Item	Debits $	Debits c.	Date	Item	Credits $	Credits c.
Feb. 2	Groceries.. ..	3	75				

Name :— POULTRY.

Date	Item	Debits		Date	Item	Credits	
		$	c.			$	c.
Feb. 1	Inventory ..	50	00	Feb. 3	3 doz. eggs ..	1	50

Name :— DAIRY.

Date	Item	Debits		Date	Item	Credits	
		$	c.			$	c.
Feb. 1	Inventory ..	1,420	00	Feb. 4	200 lbs. cream at $0.30	60	00

In order that you may know at the end of the year just what each department has produced for you, make it a rule to debit Household Expense for all farm produce used in the house, and credit the department that produced it just the same as if you had sold it to someone else.

All money that you pay out for personal expenses should be credited to cash, and debited to Personal Account.

Sometimes you will make purchases that will cause several accounts to be debited and only one account credited, as, for instance, you are running an account at the General Store. You purchase at one time groceries, harness, tools and personal clothing. Of course you will credit General Store with the whole purchase, but the amount of the groceries only will be debited to Household Expenses, harness debited to Horse Account, tools to Machinery and Tools Account, and personal items to your Personal Account.

MISCELLANEOUS REVENUE.

Once in a while you may send a team and man to work for someone else, and will be puzzled to know what to credit this up to. The simplest way out of this is to have an account headed "Miscellaneous Revenue," and value you receive that does not come out of one of the regular sales departments may be credited to this account.

BALANCING ACCOUNTS.

When we say an account is "balanced" we mean that the total of the debits in the account is equal to the total credits in the account. This shows that the account owes you nothing, and you owe the account nothing. In other words the account has been "settled." When this is found to be the case, it is usual to rule a double line at the bottom of the account to show that the account is balanced, thus :—

JOHN SMITH.

Date	Item	Debits $	Debits c.	Date	Item	Credits $	Credits c.
Feb. 1	1 ton hay	16	00	Feb. 15	Paid on account ..	16	00
,, 10	100 bushels oats at $0.60	60	00	,, 28	Paid on account ..	80	00
,, 20	4 bushels potatoes at $1.00	4	00				
,, 25	1 ton hay	16	00				
		96	00			96	00

Any additional debits or credits in this account would be made below the ruled lines, and would be the same as opening a new account under this name.

From time to time you will want to know how some particular account stands. After making a lot of entries on the debit side of the account, and quite a number on the credit side, it is impossible to tell at a glance just how much it would take to balance the account.

You don't want to add up a lot of figures every time you look at the account, so it is convenient to balance the account off and start afresh.

To do this, figure out how much it would take to balance the account, and write in the amount on the smaller side, just as though the account was paid in full. Rule the double line at the bottom of the account, total up both columns to show that the account does balance, and then start the account afresh below the line. If you had to write an amount on the credit side to make the account balance, it means that the debits were that much greater than the credits, so you start the new account below the line with a debit for this amount. Likewise, if you had to write an amount on the debit side to make the account balance, you will carry over to the new account this same amount on the credit side, thus :—

JOHN SMITH.

Date	Item	Debits $	Debits c.	Date	Item	Credits $	Credits c.
Mar. 4	2 tons hay at $16.00	32	00	Mar. 15	Paid on account ..	25	00
,, 6	110 bushel oats at $0.60	66	00				
,, 10	5 bushel potatoes at $1.00	5	00				
,, 15	1 day's work, team and man	5	00				
,, 20	1 ton hay	16	00				
				Apl. 1	Balance due ..*	99	00
		124	00			124	00
Apl. 1	Balance due ..*	99	00				

BRIGGS' GENERAL STORE.

Date	Item	Debits $	c.	Date	Item	Credits $	c.
Mar. 1	10 lbs. butter at $0.30	3	00	Mar. 1	Groceries	6	25
,, 8	15 doz. eggs at $0.40	6	00	,, 1	Hardware for new rack	4	90
,, 15	Paid cash	20	00	,, 8	1 sack flour ..	3	00
,, 15	15 lbs. butter at $0.30	4	50	,, 8	Oyster shell for chickens ..	2	00
				,, 15	Groceries and personal items..	23	75
				,, 18	4 sweat pads ..	2	40
				,, 25	New set harness..	35	00
Apl. 1	Balance owing ..*	43	80				
		77	30			$77	30
				Apl. 1	Balance owing ..*	43	80

Most business men who keep accounts make it a rule to balance off all of their accounts with other people in this way once a month, so that they can see just how they stand.

Merchants are expected to pay their bills once a month, and also like to get all outstanding accounts settled once a month.

FIGURING YOUR PROFITS.

What will interest the farmer at the end of the financial year is to know how much he has made or lost by the year's business. The simplest way to get this information will be to make out a new inventory at the end of the year as described for the beginning of the year ; balance all accounts with other people ; total up the cash on hand and in the bank, and make out a statement of Net Worth.

The difference between your net worth at the beginning of the year and your net worth at the end of the year will be your net profit or loss, as the case may be. It must be remembered that everything that the farmer has taken out of the business for personal items and living expense is really part of the profit and should be added to the profit shown by the two statements of Net Worth.

How much has the farmer taken out of the business in this way ? We will assume that all personal items, such as clothing and other necessaries, have been debited to Personal Account. Turn to Household Expense Account. This account should show the total cost of boarding yourself, your family, and your hired help. Divide the total of the account by the number of people regularly eating at your table to find the cost of boarding one. From this you can determine what it has cost

you to board the hired help. Debit General Farm Labour, and credit Household Expense for the board of hired help; and debit Personal Account and credit Household Expense for the remainder. This balances Household Expense off the books, and represents in Personal Account the amount of your profits that you have already used up in keeping yourself and family for the year. It is a profit that is not shown by the statement of Net Worth, but it is profit nevertheless and should be added to the profit as shown by the statement of Net Worth. It is an item that is often underestimated and sometimes over-estimated; so it is a good thing to have it down in black and white at the end of the year.

If your business shows a gain, or a profit, as it is usually spoken of, this profit represents two things; your earnings from your investment, and your earnings from your labour. It is easy to figure out what you could have earned from your investment if you had put all of your wealth into a savings bank at the beginning of the year.

Therefore, if you want to know what your labour income has been for the year, subtract from your total profit the amount you could have earned on your money if it had been in the savings bank. The remainder will represent your Labour Income.

Compare your labour income with the amount you could have earned if you had been working for someone else. If you are a married man, remember that your wife has been helping you to earn this money. If you will look at the "Help wanted" columns of any daily newspaper you will see such advertisements as: "Man and wife wanted for farm, \$60 a month and board"; "Man wanted for farm, \$40 a month and board." This will

give you some idea of the market value of your wife's work on the farm. If you have sons helping you on the farm, consider what they could have earned by doing the same work for some of your neighbours.

When you figure out the market value of the combined labour of yourself and family, and compare it with your labour income, you may find that you have really been working at a loss. If this is the case you want to know it ; and the next thing you will want to know is, why ? Part II. will tell you how to find out why.

Your banker will not be interested in your labour income, but he will be interested in knowing the Investment Income from your business. *Your business ability* is judged by the amount of interest you can make your business pay you, for the money you have invested in it.

To find out the amount of your investment income, subtract from your total profit the market value of your combined labour. This will give you the total of your investment income. Find out what per cent. this is of your total net worth at the beginning of the year.

Compare the per cent. of interest that you have made on your investment with the per cent. you have to pay for borrowed money ; or with the per cent. you could have earned in other safe investments.

When you have carried out your book-keeping to this point you have gained all the information that it is possible for you to get without going into the subject of "Cost Finding," which is dealt with in Part II. You have kept your accounts straight with other people, and you know what your profit has been on the year's work. If you have never kept accounts before, the practice you have gained by keeping your accounts

posted should make you feel confident to go ahead the second year and figure out your business to the smallest detail. While we consider it advisable for the average farmer to have one year's experience before attempting cost finding for himself, we would suggest, if he is anxious to know what his costs are, he may get a book-keeper in a village store or other business to help him work these out as described in Part II. Your District Representative, or any Government Officer connected with the Dominion or Provincial Departments of Agriculture, will readily give you the assistance you may need.

We would suggest that the District Representative's office be made "F.A.H.Q." (Farm Accounts Head Quarters) for your District and that you send there your farm accounts to be worked over into more valuable information (the cost of finished products could be illustrated by tables or graphs) just as you send your milk to a factory to be transformed into a more valuable commodity.

FARM ACCOUNTS.

DISCUSSION PAPER.

The Discussion Paper is planned to help the student by drawing his attention to the important points of the subject he is studying. It is intended to develop thought and self-expression of his own ideas. Each Discussion Paper, when answered and returned, is carefully read by the staff of the Department of Agriculture and a personal statement is given in connection with any question that the reader thinks the student has not fully understood. The student is invited to ask any questions that will help to give him a more complete understanding of the Course.

General Instructions.

1. Always express your ideas in your own words.
2. Finish one paper at a time.
3. See that the subject is placed at the top of the first page of each paper answered.
4. Do not forget to write your NAME, NUMBER, and COMPLETE ADDRESS, on each set of answers.
5. Number each question, and also each sheet, and pin them together in their right order.
6. Send in each paper as soon as completed.
7. After June 30th, 1919, you should mail your answers to either of the authors at his Canadian address as found in the front of the booklet.

QUESTIONS.

Farm Accounts, Part 1.

1. Why is it necessary to take an inventory of everything on the farm before starting to keep accounts?
2. Give an example of depreciation, i.e., state from your personal experience some case that you know of where a fence, building, piece of machinery, or some breeding animal has become useless through age, and state what percentage of its cost should have been figured off each year for depreciation.
3. How do you arrive at a Statement of Net Worth?
4. What is a ledger?
5. What kind of items are entered in the debit column of an account? What kind in the credit column?

6. Why would you credit your personal account with the total value of the inventory ?
7. Why is it that the total credits in the ledger exactly equal the total debits ?
8. What is the use of keeping a blotter, and what information should it show ?
9. How do you balance an account, and why is it done from time to time ?
10. What is the simplest way of finding out your profit or loss for the year, and what two kinds of income does profit represent ?

FARM ACCOUNTS

PART II

Cost Finding

Modern Methods require Modern Accounting.

Cost accounts are the basis of success in Modern Farming.

PART II

INTRODUCTION.

When you have kept accounts, as suggested in Part I. of this pamphlet, for a year or more, you should then be ready to attempt and work out the more difficult problems in cost accounting, as outlined in the following pages. By beginning on the simplest problems possible, you will soon be able to devise ways of getting all the information you will require in your business by the use of the least possible time. If you keep hens we would suggest that you start with the Poultry Department, and find out how the cost of winter eggs compares with those produced in the summer.

Cost accounts must be based on complete and accurate records to be of any value. Incomplete and unreliable cost accounts are likely to lead to unjust judgments and consequent losses.

Cost accounting will enable you to say why you are doing certain things in a certain way. Knowing why a thing is best done in a certain way will lead to improved methods of doing other things, and you will be able to help your neighbours find out what branches of their work are most profitable, and why it is best to co-operate in doing certain things. By doing this we are sure that you will get a great deal more enjoyment out of your business and life.

FIGURING YOUR COSTS.

Suppose a man who had been in the habit of earning a wage of $1,000 a year were to give up his

occupation and start into the business of making apple-boxes. We will suppose that he makes only the one kind of box. He rents a building and buys the necessary tools to carry on his work; he also buys lumber and nails, which are the raw material necessary for making boxes. As he cannot afford to stand the risk of losing his plant and material through fire, he pays out a certain amount for fire insurance. He has to hire someone to haul his raw material to his shop and the finished boxes to the shipping point. At times he has to borrow money to buy raw material, and he has to pay interest on this borrowed money. He keeps a record of all he pays out for material, rent, insurance, interest, and other expenses of running the business, so that at the end of the year he can tell the total amount that he has paid out.

At the end of the year he wants to know how much each box has cost him. He considers that his time is still worth $1,000 a year, so he adds this amount to his other expenses. Then he finds that the tools that he bought new at the beginning of the year are pretty badly used up, so he figures that they are worth only about half of what he paid for them; therefore he marks off 50 per cent. for depreciation, and adds this amount to the other expenses of making boxes.

When he totals up all of these expenses he has arrived at the total cost of making boxes for the year; he has only to divide this amount by the number of boxes he has produced and he finds the cost of each box. If he sells these boxes for one cent more than cost, he knows that he is making a clear profit on each box. If he has to sell them for less than his cost figure, he knows that he is losing money, and is not making wages out of the business.

When we consider the different items that enter into the cost of each one of these boxes, we find that each box is bearing an equal proportion of the cost of labour, material, rent, insurance, interest, and all other expenses. Nothing is left out of the cost, to be paid for out of the owner's profits.

That is what we mean when we speak of "costs" in this booklet. Not partial costs, but whole costs, which include every item that enters into the product.

The farmer's business differs from this simple illustration in that he produces many different kinds of things, instead of just the one type of product; but the general principle remains the same. He must include in the cost of each article that he produces its proper proportion of every item of expense that enters into the business.

Therefore, he must divide his business up into different departments, each department having a different kind of product. In fact, he must consider each department a little business of its own, and keep account of everything that goes into it.

It is of great advantage in business to have many departments working under one head, for there are many expenses that would have to be met by a business of only one department, that may be spread over many departments, so that the cost of production in each department is considerably lessened.

As an illustration of this, suppose that you raised only one type of field crop, say, wheat; you would have to keep horses and feed them, and the wheat would have to bear the expense of keeping the horses. But suppose you started another department, and raised hay as well as wheat. The cutting and stacking of the hay would not interfere with the planting or

harvesting of the wheat crop, yet the cost of keeping the horses would be spread over the two departments, and the cost of raising wheat would be considerably lessened thereby.

Keeping account of the expenses of the different departments is not as difficult as most people would imagine. If you have carried out the simple account system, as described in Part I., you have got through the most difficult part of it, and have already charged a good many of the items to their proper departments.

CHARGING FEED TO LIVE STOCK.

In Part I. we did not touch upon home-grown feeds for the live stock. In order to figure costs you must know how much feed is consumed by each class of animals.

In the minds of a great many farmers this will appear to be an unsurmountable barrier to a cost system, as they consider it impossible to keep account of the feed given to the various kinds of animals. But it is not as difficult as it seems. In the Appendix will be found rules for measuring the weight or contents of stacks, bins, etc. If a stack is to be fed to the dairy cows, measure up the stack and charge the whole thing to dairy at the market value. If a mow full of hay is to be fed to both cattle and horses, measure it up and find the total value of it; on one or two days during the time that you are feeding this hay, weigh up the amount you are feeding to each class of stock, and find the proportion that goes to each. When the mow is finished charge it to these two live-stock departments in the proportion that you have been feeding it to each. For feeding grain, the simplest way is to set apart a feed bin for different

classes of stock, and charge their account for the value of grain you put into it every time you have to fill it. Or, if you feed several kinds of stock out of the one bin, find the proportion that goes to each by either weighing or measuring one or two days' feedings. Many simple ways will suggest themselves to the farmer who tries to keep account of his feed.

The main thing is to debit the live stock departments and credit general produce account with the value of the feed based on market value. Later on you may find out that these feeds cost you considerably less than this to produce; in that case it is quite all right to let the profit appear in the department that produced the crop.

Pasturage should also be debited to live stock. In charging pasturage to live stock it is customary to charge at the rate of $1 to $1.50 per month for each head of horses or cattle. If the pasture is seeded pasture, credit the amount of pasturage to hay crop. If it is wild pasture, credit the value of pasture to "Land Expense."

PERSONAL LABOUR.

Another important item that must be put on the books in order to figure out your cost is the value of your own labour and the labour of any members of the family who help with the farm work. Credit your "Personal" account, and debit "General Farm Labour" account, for what you consider a fair market value for your labour and the cost of your board.

In order to divide "General Farm Labour" account up, and spread it over the various departments and crops, at the end of the year a special record must be kept, called the "Time Record."

TIME RECORD.

The "Time Record" should be started at the beginning of the year, at the same time as the ledger accounts. In it you will keep a record of the time of men, horses, and machines spent in various departments and in the production of the various crops.

For this purpose select a book similar to the one used for an inventory book, about 12 ins. by 9 ins., with feint ruled lines across the page. Rule perpendicular lines on the pages that you are going to use, and write in the headings as follows:—

Date	Kind of Work	Man Hours	Horse Hours	Machine Hours	Kind of Machine

Set apart one or more pages for every department or account that you use labour upon, whether it be man labour, horse labour, or machines.

Land would have two pages; one for time spent on Land Improvements, and one for Land Expense, which would include all labour or time spent repairing fences, manuring the land, etc.

Buildings would have two pages; one for Building Improvements and the other for Building Repairs, etc.

Machine Expense should have a page for recording time spent repairing machines, etc.

Horses, Dairy, Swine, Sheep and Poultry should each have a page, for recording time spent on these animals for feeding and general upkeep.

Garden and Orchard may have one page, or it may be divided up into several smaller departments, so as to keep a record of time spent on each crop (see General Produce).

General Produce should have a page for recording time spent handling old crops after they have been taken off the field; but this department should be divided up, and a page given to each new field crop, such as wheat, oats, barley, corn, potatoes, hay, roots, etc., so that a record can be kept of the time spent on these various crops.

If you have an account with Miscellaneous Revenue, a page in the Time Record should be given to this account, so as to keep a record of any time spent on producing the miscellaneous revenues.

The keeping of the Time Record is very simple, and will take but a few moments daily. Every evening, when you have posted your ledger accounts, turn to the Time Record and enter up the principal work that you have been doing that day. That is, if you have been ploughing all day on a field for oats, turn to the Time Record page for Oats, and enter the date; in the next column the word "Ploughing"; in the next column the number of hours you have worked; in the next column the combined number of hours the horses have worked, figured on the basis of one horse; that is, if you have been working

four horses for nine hours, you would put down thirty-six hours for horses; under Machine Hours put down the number of hours you have used the plough, and under the heading "Kind of Machine," the word "Gang-plough" or "Sulkey," or whatever it may be.

As another example, suppose you spend two hours going to town with your cream, two hours hauling manure on to the land, and four hours in the afternoon harrowing the wheat field, you would only have these three entries to make in the Time Record: Under "Dairy," the date; "trip to town," man hours 2, horse hours 4 (if you use two horses); machine hours 2; and kind of machine, "wagon." Under "Land Expenses," the date; "manuring," man hours 2, horse hours 4, machine hours 2, kind of machine, "manure spreader" or "wagon," as the case might be. Under "Wheat," the date; "Harrowing," man hours 4, horse hours 16 (if you used four horses), machine hours 4, and kind of machine, "spike-tooth" or "disc," as the case might be.

Once a week figure up the average amount of time you spend every day on the regular chores, such as feeding and caring for horses, feeding and milking cows, feeding hogs, sheep and poultry, caring for engine, etc., and record the total time spent during the week on these various chores, under their proper headings in the Time Record.

If you have a hired man or anyone else helping you with the farm work, of course, their time, and the time they work the horses and machines will be entered in the Time Record too. It is not necessary to keep a separate record of each individual's time. The aggregate number of hours, of men, horses and machines is all you require.

At the end of the year your Time Record will give you two kinds of information. First, it will show you the total amount of time spent on each crop and in each department; and, second, by adding up all the totals you will find the grand total of man hours and horse hours used in productive work on the farm. By checking the two right-hand columns throughout the Time Record, you can find out the total number of hours you have used any piece of machinery during the year.

DISTRIBUTION OF LABOUR—MAN LABOUR.

If you turn to your "General Farm Labour" account in the ledger you find that you have quite a sum debited to this account. Take the total of this account and divide it by the total number of productive man hours shown by the Time Record, and you will find out the cost of each hour of man labour.

This figure may surprise you if you have been estimating man labour at the rate of fifteen or twenty cents an hour, but if you have been keeping accurate records you will know that it is an actual fact.

Your Time Record will show the number of hours to be charged to each account in the ledger. You may now debit each account that has used man labour with the number of hours at the rate shown by your cost. Each time you debit an account for labour you must credit "General Farm Labour" account, so that when you have finished posting labour you will find that "General Farm Labour" account has been balanced.

In order to do your posting, some new accounts must be opened in the ledger; that is, for the various field crops that you have been keeping time on, and

any departments that you may have divided "Garden and Orchard" into.

Time spent on improvement to land or buildings will be charged direct to these accounts, but time spent on repairs to buildings should be charged to "General Expense" account. You have an account with "Land Expense," so time spent on repairs to fences or manuring the land will be charged to this account. Time spent on horses should be debited to "Horse Expense."

DISTRIBUTION OF LABOUR—HORSE LABOUR.

Before figuring out the cost of horse labour, examine "Horse Expense" account and see if it is all right. If you have figured that some of your horses have depreciated in value on account of age, the amount of depreciation should be debited to "Horse Expense" and credited to "Horses." If you have raised some colts you will know that a portion of "Horse Expense" has been caused by the care and feeding of the colts. You have also reduced the number of productive horse hours by the time lost by the mares breeding and foaling. Let us consider that you keep horses solely for the purpose of work, and that you raise colts as a side line for the purpose of reducing the cost of horse power. In that case credit "Horse Expense" for the value of the colts raised during the year, and debit "Horses."

On a farm where horses are raised for profit, apart from the work, a separate account would have to be kept of time and feed used in their production, the same as in the case of swine and sheep.

When you have arrived at the total of "Horse

Expense," divide this sum by the total number of horse hours, as shown by the Time Record, and you will find out the cost of each hour of horse labour.

Debit each department or crop with the value of horse labour used, according to the number of hours shown by the Time Record, credit "Horse Expense" for each one of these amounts, and this account will be balanced off the books.

If there have been any horse hours charged against "General Farm Labour" or "Household Expense" in the Time Record, strike these out of your calculations entirely, as these two accounts are off the books before you get to "Horse Expense," and the final result will be the same, as you will see later. Likewise, any horse hours chargeable to "Horse Expense" would be left out of your calculations, as they will not affect the final cost figures.

DISTRIBUTION OF MACHINE LABOUR.

The account in the ledger called "Machine Expense" is the next account to be disposed of, by charging it to the other accounts in the same manner as "General Farm Labour" and "Horse Expense."

You will find this account complete with the exception of one item—that of depreciation. Figure out the amount you are marking off your inventory each year for depreciation of machinery and tools, and debit "Machine Expense" for the amount. Credit "Machinery and Tools" account.

But we cannot arrive at a fair cost of operating the machinery as easily as we have the cost of man labour and horse labour. We should divide this account up into several different classes of machines and implements, and find the cost of operating each kind.

To do this, take a separate sheet of paper and rule it off in the following manner:—

	Wagons, Sleighs, etc.	Tillage Implements.	Seeder and Binder	Haying Implements.	Engine, Chopper and Pump.	Small Tools, etc.	Total.
Depreciation							
Repairs ..							
Other Expenses							
" "							
" "							
Totals.. ..							
Number hours used ..							
Cost per hour							

By going over the various debits against "Machine Expense" you will be able to distribute the whole of this account over the different types of machines, and to arrive at the total cost of operating each kind.

Now go through your Time Record and figure out the total number of hours that you have used each

type of machine or implement. Divide the total cost of each type by the total number of hours that type of machine has been used, and you arrive at the cost of operating each type for one hour.

Debit each account for the value of machine labour used in that department, and credit "Machine Expense" for a like amount.

You will find that there is still a small balance left in "Machine Expense" account, owing to small tools expense not being chargeable to any particular account. Debit "General Expense" account for this balance, credit "Machine Expense," and that clears this account off the books.

Machine time used for "General Farm Labour" or for "Horse Expense" will be struck off before making any calculations. This will consist mostly of use of wagons, and will cause an increase in the cost of operating wagons of only a fraction of a cent per hour.

DISTRIBUTION OF LAND EXPENSES.

Under the account of "Land Expense" you will have charged all items of expense, labour, etc., expended on the unkeep of the land. Add to this account the amount you are marking off your land inventory each year for depreciation on fences, and credit this amount to "Land" account.

Divide the total of "Land Expense" account by the total number of acres under cultivation (exclusive of Garden and Orchard and the Farmstead), and you will find the cost of upkeep of each acre for one year. You may find it convenient to make a further division and find the cost per acre for one month.

Debit each one of the field crop accounts, according to the number of acres allotted to each, and the

number of months the land has been turned over to them. Credit "Land Expense" for each amount, and this will balance this account.

All accounts in the ledger should now be complete so far as direct expense is concerned, except the charging of seed and threshing to the field crop accounts. Debit each field crop with the value of seed used on it, the cost of threshing, and the cost of the formalin used for treating the seed, etc. Credit "General Produce" account for the seed and threshing, and "General Expense" for the formalin if you had previously charged the formalin to "General Expense" account.

DISTRIBUTION OF GENERAL EXPENSES.

Now you are ready to deal with "General Expense" account, and you will find this account complete except for the items of depreciation on buildings and interest on your own investment. Figure depreciation out from your inventory on buildings, debit "General Expense" account and credit "Buildings" account. Now figure out the amount of interest you could have made from your total investment, as shown by your Statement of Net Worth at the beginning of the year if you had placed it in the savings bank. Credit "Personal" account and debit "General Expense" with this amount.

This item of interest on your own investment is just as important in your cost figures as the interest on borrowed money, as comparisons from year to year and with other people's costs cannot be made without figuring this item in. Find the total of "General Expense."

Now total up the expense items in each of the other accounts. There will be none in "Land," "Build-

ings," "Machinery and Tools," or "Horses," the expense items in connection with these accounts having been distributed. "Dairy" expense will include everything on the debit side except the inventory value at the beginning of the year and any new cows or machinery bought during the year. "Swine," "Sheep," and "Poultry" expense will include everything on the debit side of these accounts except the inventory at the beginning of the year, and any new breeding stock or equipment bought during the year. "Garden and Orchard" everything except the inventory and the cost of any permanent improvements. "General Produce" account should have no expense items in it except the cost of hauling produce to town. "Field Crops" account will be all expense.

When you have found these totals, add up the grand total of all expense, exclusive of "General Expense."

Find out what percentage "General Expense" is of all other expense. To do this, multiply "General Expense" by 100 and divide by the total of all other expense.

Whatever this percentage proves to be, it shows the percentage that must be added to each of the other expense totals to make the departments bear their proper proportion of "General Expense."

Debit each productive department's account with its proportion of general expense, and credit "General Expense" account; this will balance this account off the books.

CLOSING THE ACCOUNTS.

You are now ready to balance off all of the departmental accounts, and to figure out your loss and gain by departments.

But before you can do this you should enter the inventory, taken at the end of the year, to the CREDIT side of each account, and debit "Personal" account for the total inventory.

After you have done this, open a new account in the back of the ledger under the heading of "Loss and Gain."

Now "balance" all departmental accounts in the ledger, as described in Part I. of this book. If you have to write an amount on the debit side of an account in order to make it balance, write an equal amount on the credit side of "Loss and Gain" account. If you have to write an amount on the credit side of an account to make it balance, write an equal amount on the debit side of "Loss and Gain" account. When you have closed all of your departmental accounts, all of the amounts on the credit side of "Loss and Gain" account will represent profits and all those on the debit side will represent losses.

When closing the accounts of "General Produce" and the various field crop accounts, remember that field crops are a part of "General Produce." Credit each field crop with its portion of the inventory value of the crop on hand, together with all credits for sales of that particular crop. Thus you will be able to see your loss or gain on each crop. This may show "General Produce" with a small loss, due to shrinkage of grain from the previous year, as well as from the cost of hauling grain to market. If this turns out to be a uniform loss from year to year, it should be figured out as a percentage to be added to the cost of field crops, for handling, etc.

The total profit shown by the "Loss and Gain" account should correspond with the total profit arrived at by the method described in Part I.

Account :— LOSS AND GAIN.

Date		Debits $	c.	Date		Credits $	c.
	Swine	25	00		Wheat (see Wheat Accounts, p. 60)	*190	00
	Barley	18	00		Oats	125	00
	Potatoes	80	00		Hay	60	00
	General Produce .	40	00		Dairy	680	00
					Sheep	80	00
					Poultry	25	00
					Garden and Orchard ..	225	00
					Miscellaneous Revenue ..	65	00
	BALANCE (enter on debit side of Personal Accts.)	1,287	00				
		1,450	00			1,450	00

Account :— WHEAT.

Date		Debits $	c.	Date		Credits $	c.
	Man Labour ..	68	00		Wheat sold from this crop ..	300	00
	Horse Labour ..	151	00		Inventory of wheat on hand from this crop	450	00
	Tillage implements	5	00				
	Binder and Drill ..	6	00				
	Wagons	11	00				
	Land Expense ..	100	00				
	Seed and Formalin	54	00				
	Threshing ..	60	00				
	General Expense .	105	00				
	To Loss and Gain (balance)	*190	00				
		750	00			750	00

COST OF PRODUCTION.

To find the cost per bushel of any kind of grain, you have simply to divide the total cost of producing the crop, including its proportion of "General Expense," by the total number of bushels produced, and you find the cost of one bushel.

To find the cost per pound of cream, take the total cost of the dairy herd, deduct the proceeds from the sale of any by-products, such as calves and skimmed milk, and also the inventory value of any calves still on hand; divide the remainder by the number of pounds of cream produced, and you find the cost of each pound.

To find the cost of a pound of mutton, take the total cost of sheep, deduct the value of all wool produced, and divide the remainder by the number of pounds of mutton produced.

The cost per pound of pork is found in the same way, only there is no by-product to deduct.

What to do with your Cost Figures.

When you have figured out the cost of your various products, analyse them. Look at the various items that have gone into the cost.

Labour is one of the big items in cost of production. Perhaps you have not been getting enough productive hours out of the labour you have been paying for. See if there is any way that you can profitably utilise some of the time that goes to waste on the farm, and thereby reduce the cost of labour by increasing the number of hours.

Perhaps you are keeping too many horses for the amount of work they do. See if you can reduce the

cost of horse labour by increasing the number of hours worked.

Perhaps you are feeding too expensive foods. It doesn't pay you to feed seed oats when you can buy feed oats from a neighbour at several cents a bushel cheaper. Even if the saving in cost of food only pays you for hauling your oats to town, if you do this in a slack time you are reducing the cost of your horse and man labour. Compare all of your foods in the same way, and see if you can utilise cheaper foods that are just as good for the purpose.

Above all things, if you are a member of a farmers' organisation, take your cost figures to the secretary. He may be able to help you in many ways, and your figures may enable him to help others.

Talk costs with your neighbours. If any of your neighbours figure out their costs, compare figures with them. You can do more toward reducing your costs by comparisons that by any other means.

Get the cost movement started in your neighbourhood. Knowledge is Power. Make the most of it.

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QUESTIONS.

Farm Accounts Part II.

1. Give a simple definition of what is meant by the term "cost of production."

2. Why is it necessary to divide the business up into different departments, and keep records for each department?

3. Why would you charge feed to live stock at market value, even if you knew that it cost you considerably less than this to produce?

4. What information will you get from the "Time Record" at the end of the year?

5. How do you make each crop or department bear its proper proportion of the cost of labour?

6. If you were figuring labour at the rate of $45 a month, plus $15 per month for board, an average working day of twelve hours, six days a week, should make this work out at about 20 cents per hour. What would it signify if you found man labour under these conditions costing you 25 cents per hour?

7. How do you distribute "Land Expense" over the various crops?

8. How do you distribute "General Expense"?

9. Why is it necessary to post the new inventory to the credit side of the different accounts before closing the accounts and taking off the "Loss and Gain" account?

10. State how you would find out the cost of producing a bushel of grain; a pound of butter fat.

To find the number of tons of hay in mow or stack: Multiply the length by the width by the height, all in feet, and divide as follows: If heavy wild hay, divide by 400; if clover or alfalfa, well settled, divide by 500; if straw, well settled, 600 to 700; if straw, not settled, 1,000.

To find the number of measured bushels of grain or roots in a bin: Multiply the length by the width by the average height, all in feet. Multiply this by 25 and divide by 32.

The following table shows the number of tons of ensilage in silos of different diameters and depths:—

Depth of Ensilage in feet.	Inside diameter of Silo in feet:—				
	8	10	12	14	16 feet
	Tons.	Tons.	Tons:	Tons.	Tons.
20	16	26	38	51	67
21	18	28	40	55	72
22	19	30	43	59	77
23	20	32	46	63	82
24	21	34	49	66	87
25	22	36	52	70	90
26	23	38	55	74	97
27	25	40	58	79	103
28	26	42	61	83	108
29	27	44	64	87	114
30	29	47	67	91	119
31	30	49	70	96	125
32	32	51	74	100	131
33	33	53	77	105	138
34	34	56	80	109	143
35	35	58	84	114	149
36	36	61	87	118	155
37	38	63	90	123	161
38	39	66	94	128	167
39	40	68	97	133	174
40	42	70	101	138	180

One quart of milk weighs 2½ lbs. To change quarts into pounds multiply by 2.5. To change pounds into quarts, divide by 2.5.

Depreciation of Farm Machinery.—The following table shows the annual average depreciation on different machines, on a large number of farms in Minnesota. (From *Minn. Bulletin*, 117).

	Per Cent.
Threshing Outfits	12.00
Hay Loaders	11.78
Manure Spreaders	11.67
Corn Binders	10.03
Harrows	8.72
Sulkey Ploughs	8.42
Reapers	8.13
Grain Binders	7.91
Mowers	7.80
Hay Rakes	7.80
Hay Racks	7.76
Gang Ploughs	7.40
Gasoline Engines	7.35
Corn Cultivators	7.25
Corn Planters	7.15
Grain Drills and Seeders ...	6.75
Harness (heavy)	6.17
Walking Ploughs	6.09
Sleds	5.81
Horse Weeders	5.71
Discs	5.19
Wagons	4.89
Hay Tedders	4.84
Fanning Mills	4.58
Grain Tanks	3.47

VALUE OF MANURE.

Some farmers will want to credit their live stock with the value of manure produced, and make a debit against "Land Expense" for this amount. To estimate the value of manure from various classes of live stock, the following table will be found useful. For each 1,000 lbs. live weight:—

	Excrement per Year.	Manure with Bedding per Year.	Nitrogen per Year.	Phosphoric Acid per Year.	Potash per Year.
	Tons.	Tons.	Pounds.	Pounds.	Pounds.
Horse	8.9	12.1	153	81	150
Cow	13.5	14.6	137	92	140
Sheep	6.2	9.6	175	88	133
Calf	12.4	14.8	150	105	102
Pig	15.3	18.2	331	158	130
Fowls	4.3	——	293	119	72

It is hard to estimate the value of manure, as compared with the cost of commercial fertilisers, owing to the greater cost of putting manure on the land. On most farms manure is estimated at $1 per ton at the barn.

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Choosing a Farm

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MOS INTER BELLUM NATUS

Choosing a Farm

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Choosing a Farm.

What is known as a farm is an area of land used to produce materials necessary for the sustenance of the human race.

The methods adopted in the choosing and management of the farm are the products of the ages. Ever since the site of the first farm was chosen and planted "Eastward in Eden," every generation of farmers has been choosing farms. It has been estimated that the average farm changes from one owner to another three times every century.

Almost every country has tons and tons of records describing the boundaries and areas of farms. The details of the purchase are set forth in minute detail but the reasons which led up to the sale and purchase cannot be found in the office of the Registrar of Deeds, and very few books are available on the subject.

Instructors in the Canadian Khaki Colleges have frequently been asked for suggestions that would enable a man to invest his time and money most advantageously. From every quarter the same question is asked. How am I to choose a farm ? A few general principles are suggested in this article, which we hope will be some help to the thousands who are now troubled with this important problem.

Importance of Choice.

Take your own time in choosing a farm. Don't be hurried by any one. It is the most important decision in connection with your business that you have to make and second only to the choice of your life helpmate. When possible, visit any farm that you propose to buy at several different seasons of the year. Go over it very carefully each time and make notes on the features that appeal to you and those that are objectionable. If possible or convenient, arrange to

work on the farm or in the neighbourhood so that you may study the advantages and disadvantages of the farm and the locality for your own special purpose. Every farm must be judged on its own merits and on its condition at the time of purchase. The character and sociability of the neighbours will be of much greater importance to you than the character and fertility of the adjoining farms. Many farms are heavily

Vigorous Clover indicates Fertility.

cropped without being adequately manured or cultivated (soil mining describes the practice) and then sold on the record of their performance during the period. The man who buys on that basis starts his business under a very heavy handicap.

The Community.

It is taken for granted that in the choice of the particular community you are prospecting for a suitable farm you have satisfied yourself that the seasons, rainfall, sunshine

and climate generally are suitable to the line of farming you plan to follow. That the region is healthy. That you avoid locations subject to late and early frosts when growing tender plants. That it is near enough to store and markets for your purpose. That there is a satisfactory school and church for your family, and that other community

A Home-like Farm.

essentials, such as a reliable family doctor, a blacksmith, cobbler and other tradesmen, are near. That the mail, telephone and telegraph service come within easy reach. That the roads are suitable and good of their kind, and that shipping facilities by water, trolley or railway are either adequate or that they are about to be constructed. When any of these necessities have to be

supplied it is well to remember that the industries of the community eventually pay for them. In a farming community the farms pay for them ; though the payment be deferred and may only appear as interest on invested capital. It is true on the other hand that every community improvement adds to the land value of every farm in the district. In some regions a large part of the farmers' wealth comes from this source. The holding of such land is a business investment the same as owning a factory, store or ship.

What to Look For.

You alone know just what you are looking for. Every farm is HOME to the children, and the character of the community is more important than profits from that standpoint.

The innumerable types of farms and farming places a detailed description of any one farm outside the scope of this article. Everyone should look for a good deed unless purchasing through the Soldier Settlement Board. Have a competent lawyer make a

A Fertile Soil produces Uniform Root Crops.

search of the title. It will be money well spent. Look for fertile land or land that you know can be made fertile by the investment

of money, labour and brains. To the average man this is the most important point of all. Specialists can farm special soils and produce good profits, but the ordinary man should not accept a handicap at the start. Look for the District Representative or the Superintendent of the nearest Experimental Station. Ask him about the community and the land. Get a soil auger and go over the property, investigating the character of the soil and sub-soil. Make a plan of the fields and take to him any of the soil samples that you are doubtful about. Look for a friable mellow soil that can be easily worked under favourable conditions, and when unfavourable conditions occur can still be handled safely with a reasonable expenditure of labour. It is always safe to choose land that is naturally good. If nature through the ages has grown good strong crops and allowed them to decay and produce better crops you may safely count on such land feeding your plants and stock under normal conditions. Look for water and make sure it is pure and in sufficient quantities throughout the year for your requirements on the farm. Find out how much it will cost to pump or convey the water needed for one year's farm operations.

Look for strong, vigorous growth during the growing season. Large vigorous trees, shrubs and plants always indicate that conditions for plant growth are favourable. The habit of growth of weeds is often a good indicator of the value of the land. In certain localities the presence of certain plants are said to indicate fertility, other plants are said to indicate the presence of acid in the soil, while some plants are always known locally as "poverty weeds." The last group are hardy and will grow under very adverse conditions. Their presence is generally said to indicate poor soils, but they may also be found in fertile places. Plants that are not considered hardy when found in abundance

are said to indicate rich soils, but any one of them may also be found growing on poor soils. How then can plants help you in choosing a farm ? Simply forget individuals and look for groups. In fertile land the following plants grow vigorously and when within their natural zone they grow abundantly : Clover, corn, wheat, Kentucky blue-grass, ash, maple, walnut, crab apple, couch (or quack) grass and Canada thistles. Poor land is likely to have a predominance of the following plants : Red-top, rye, buckwheat, chesnut, pine, hemlock, spruce, daisy, cinque foil. hawkweeds, sorrel and golden rod.

Look for a farm that is large enough to meet your labour requirements. Do not get one too large or too small but one on which you can do your best work. Examine carefully the topography or lay of the land. Steep hillsides are costly to work and frequently wash badly. If such land can be kept in permanent pasture or in growing wood and lumber, it may be very valuable in conjunction with sufficient arable land. See that the general layout or plan of the farm is good. That the number, size and shape of the fields are such that they can be worked and fenced economically. Look for a farmstead centrally located so as to avoid unnecessary hauling of manure and crops. See that you will have good shelter from the prevailing winds and storms and that it will be possible to make your surroundings comfortable, convenient and homelike.

What to Avoid.

Avoid land under dispute as to the title or boundaries. Keep away from a backward community unless you are a missionary or have the gift of leadership. The people make the place, and the one who introduces new methods has always had a hard row to hoe. Avoid poorly drained land whether naturally or artificially unless you have the

capital to improve it. Avoid alkali soils in dry regions. Beware of land infested with noxious weeds, insects or plant diseases. Unless you have had previous experience in reclaiming neglected land, leave the run out farms for others. Never buy land because the auctioneer says it is cheap. Avoid land that is in poor condition containing swales, many stones or large stumps, as these are very costly to fill or remove at the present price of labour.

Summary.

1. Read books on choosing a farm. "How to Choose a Farm" (Hunt), and "Farm Management" (Warren) are recommended.
2. Take sufficient time in making your choice so that your business foundation may be solid.
3. Select your community carefully. Study its past; make sure you want to share its present; believe in its future and be one to make it the best in Canada. This will speed the day when we shall have a Greater Canada. A Canada more worthy of her sons "who sleep in Flanders' fields."
4. Knowledge is power. Know what kind of a farm you want and seek it diligently until you find it.
5. Avoid starting your business under a handicap. It will be time enough to experiment with avoidable difficulties when you have gained experience. Leave them for the Agricultural Colleges and Experimental Stations. By keeping in touch with the nearest of these institutions you will save much time and money.
6. Choose an opportune time to make your purchase. Your own commonsense, which is your most valuable asset in farming, will be your best guide.
7. If we can give you any further help, it is at your service. When in doubt, ask the Khaki University of Canada.

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